

**An Analysis of the Demand for Money**  
**With Particular Reference to**  
**Australia.**

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Preface

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LIST OF ABBREVIATIONS

Am. Econ. Rev.:	American Economic Review
Ban.:	The Banker
Ban. Mag.:	Bankers' Magazine
Ban. N. Lav.:	Quarterly Review of the Banca Nazionale del Lavoro
B. Ox. Inst. Stats.:	Bulletin of the Oxford Institute of Statistics
Can. J. Econ. Pol. Sc.:	Canadian Journal of Economics and Political Science
Econ. J.:	Economic Journal
Econ. Rec.:	Economic Record
J. Inst. Actuaries:	Journal of the Institute of Actuaries
J. Finance:	Journal of Finance
J. Pol. Econ.:	Journal of Political Economy
Lloyds Bank Rev.:	Lloyds Bank Review
Lon. & Cam. Econ. B.:	London and Cambridge Economic Bulletin
Man. School:	Manchester School of Economics and Social Studies
Midland Bank Rev.:	Midland Bank Review
Nat. Inst. Econ. Rev.:	National Institute Economic Review
Ox. Econ. Papers:	Oxford Economic Papers
Quart. J. Econ.:	Quarterly Journal of Economics
Rev. Econ. Stats.:	Review of Economics and Statistics
Rev. Econ. Stud.:	Review of Economic Studies
Scottish J. Pol. Econ.:	Scottish Journal of Political Economy
Southern Econ. J.:	Southern Economic Journal
Three Banks Rev.:	Three Banks Review
Westminster Bank Rev.:	Westminster Bank Review
York. B.:	Yorkshire Bulletin of Economics and Social Research



## CHAPTER ONE

### INTRODUCTION

#### A. The Importance of the Demand for Money

The purpose of the analysis presented in the following chapters is to consider some of the more important theoretical and empirical questions associated with the concept of the demand for money and its implications for monetary policy. To begin with, the significance of the demand for money warrants consideration. The following selection of comments on the importance of the demand for money encompasses the main points to be considered:

The demand for money is "... an interesting economic relationship and ought to be studied in its own right ..."<sup>1</sup>

Quantity theorists "... tended to become preoccupied with arithmetic examples designed to illuminate more or less mechanical aspects of money flows and did not develop the idea of a velocity function - a demand function for money."<sup>2</sup>

"It is part of the functions of the monetary authorities, including the Reserve Bank, to understand these fluctuations in

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1. Klein, L.R. and others. An Econometric Model of the United Kingdom. 1961. p. 83.
  2. Selden, R.T. Monetary Velocity in the United States (in Essays in the Quantity Theory of Money. M. Friedman (ed.) 1956.) p. 233.

people's attitude towards liquidity and to mitigate their effects. This is difficult partly because of a lack of information ..."<sup>3</sup>

"... we must be wary of building into the economy such excesses of liquidity that would take years to work off, blunt the effectiveness of our monetary tools, and lay the basis for unavoidable inflationary repercussions."<sup>4</sup>

"Both our understanding of and our capacity to influence the effects of changing attitudes towards liquidity are limited and uncertain and it is increasingly important that they be improved."<sup>5</sup>

"Unless the demand for money - defined to correspond to some quantity the central bank can influence - can be shown to be a stable function of a few key variables, the quantity of money must be a subordinate and not a strategic element in both the explanation and the control of economic activity."<sup>6</sup>

A number of arguments providing support for the need for a demand-for-money function emerge:

1. It is an interesting relationship and the certainty

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3. Coombs, H.C. Other People's Money. Sir John Morris Memorial Lecture, 1962. p. 15.

4. First National City Bank of New York. Interest Rates and Liquidity. (In Monthly Letter of the First National City Bank, September, 1962: 100-103). p. 103.

5. Reserve Bank of Australia. Report and Financial Statements, 30th June, 1962. p. 15.

6. Johnson, H.G. Monetary Theory and Policy (in Am. Econ. Rev. Vol. 52, No. 3: 335-384, 1962.) p. 351.

of knowledge about its general form, and probably of its specific nature would be useful in the treatment of economic theory. Given more knowledge of economic relationships, discussions in the field of theory can provide more certain and specific conclusions, and certainly these discussions would be facilitated and rendered more objective. Even if the discussion were not concerned directly with monetary theory, a better knowledge of the monetary factor, and the way in which it operates, would make the discussion easier and more useful, since no field of economics can be entirely divorced from all other fields. Reference must be made to these other fields and their influence must be taken into account in discussing one subject in particular. Thus, even if the demand-for-money function is not important in itself it is relevant, as described, in studies in areas of economics where a knowledge of the demand for money, though not an essential part of the picture, is indirectly useful.

2. The demand-for-money function involves key economic variables, and may be helpful in completing economic models. For any model to be soluble it needs to consist of the same number of equations as variables. The model of the type used by Keynes<sup>7</sup> will provide an illustration of this.

In the three equations:

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7. Keynes, J.M. The General Theory of Employment, Interest and Money. 1936.

4.

$$C = f_1(Y)$$

$$I = f_2(r)$$

$$Y = C + I$$

C is consumption

I is investment

r is the rate of interest

Y is income.

There are any number of income levels which will satisfy the conditions of the model. There is no unique solution because there are four variables in a system of three equations. In the equations

$$L = f_3(r, Y)$$

$$L = M$$

M is the actual quantity of money

L is the quantity demanded.

Combining these two sets of equations and regarding the actual quantity of money as a datum we have a model of five equations with five variables. Therefore we can now arrive at a single equilibrium level of income. We are concerned with the equilibrium level of income not the demand for money, but the demand-for-money function is an essential part of the model required for income determination, although other economic relationships might conceivably be used to complete the model.

Similarly with other models it may be found convenient to

complete them with the demand-for-money function. For instance, the quarterly model presented by Klein<sup>8</sup> which is concerned with trade cycle analysis and the determination of levels of economic activity consists of thirty-seven equations. For the model to yield determinate results there must be the same number of variables and this is in fact the case.<sup>9</sup> The liquidity-preference function does not add any further variables, other than predetermined variables, to the model and therefore its exclusion would result in the model being reduced to thirty-six equations with thirty-seven variables. Thus the model will not yield a determinate solution without the liquidity-preference function. Consequently the inclusion of the liquidity-preference function can be said to complete the model.

Even if the demand-for-money function is of no real use in itself it may be a very useful relationship in completing econometric models as just outlined.

3. A demand-for-money function would provide information which is relevant for policy-making, and in particular would be useful in forecasting. As an example of forecasting, if we have, as a part of a model, a demand-for-money function relating income, interest rates and the quantity of money, provided that the rest of

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8. Klein, L.R. and others. An Econometric Model of the United Kingdom, 1961. See pp. 40-109.

9. There are other variables in the model but they are predetermined.

the model yielded information about the rate of interest, and provided also that the demand-for-money function is stable and provides a complete explanation of the quantity of money, knowledge of the quantity of money should enable the level of income to be forecast. If the relationship explaining the demand for money related simply the rate of interest and the level of income to the quantity of money, then controls over the rate of interest or a knowledge of its behaviour would make the effects of changes in the quantity of money upon income predictable.

The relevance of the nature of the demand for money for economic policy is apparent particularly from the statement drawn from the Monthly Letter of the First National City Bank of New York.<sup>10</sup> From this statement it can be seen that some idea of what is a sufficient degree of liquidity, what determines it, and how it changes is necessary. The other comments noted<sup>11</sup> provide further evidence of the importance of knowledge about the demand for money for monetary management. An example of the significance of knowledge relating to the demand for money is in connection with the rate of change of prices. If the explanation for the quantity of money demanded is to be found, at least in part, in the rate of change of prices, so that an increase in the "general level of prices" will lead to a fall in the quantity of money demanded, the

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10. p. 2 above.

11. pp. 1-2 above.

possibility of run-away inflation would be increased by a supply of money in excess of the quantity demanded. Under such circumstances attempts by individuals to reduce their money holdings, by buying assets and goods and services, would tend to lead to price increases which in turn would reduce the quantity of money demanded, and so the process would continue with the possibility of prices rising at an increasingly rapid rate. The possible results attendant upon such a price-money relationship will be dealt with more fully in chapter three. It is certainly a possibility which is relevant for monetary policy. In such circumstances a knowledge of the demand-for-money function is essential for monetary policy to be an effective means of countering price inflation.

### B. Liquidity and Money

While discussing the demand for money, the question should be asked: why is there a demand for money? As with any economic good the demand for money exists because money fulfills some need. The particular attribute of money from which its demand stems is its high liquidity.<sup>12</sup> In fact money is perfectly liquid, although its liquidity relative to that of other goods may vary over time.

The liquidity of an asset depends upon two factors:<sup>13</sup>

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12. The point is made, in effect, in references to "liquidity preference" which are made by Keynes in *The General Theory*, when discussing the demand for money.

13. These criteria are used by Wilson: Wilson, T. *Inflation*, 1961. See p. 188.

1(a) The time and trouble required to convert an asset into the medium of exchange;

(b) The costs, if any, involved in selling an asset (e.g. stamp duty, brokerage).

2. The certainty regarding the price to be obtained and the expected level of that price.

The first point is self-explanatory. The time required to market a building for instance through normal channels would be much greater than that required for government securities. On the second point, the more certain is the holder of the future value of an asset, the more liquid is that asset, *cet. par.*, as it can be realised at any future date at a known price. Thus the second point relates to the risk of capital loss.

The two points in conjunction determine the liquidity of an asset. For instance, if a building is the asset in question, it may be converted into liquid form very rapidly, but probably at a price involving a considerable capital loss to the seller. The two points must be considered together to gain some idea of the liquidity of an asset. Once the time that is required to market the building satisfactorily, thereby obtaining the best price, is taken into account, the asset certainly cannot be considered as a highly liquid one, particularly as it is unlikely that price expectations are very precise, being dependent upon the stability of the market over time. A market of this sort is much more susceptible to price fluctuations than a market for an asset, such



as securities, whose value is fixed in terms of money at some future date. With liquidity so defined money is perfectly liquid as there is no conversion required, and its future value in nominal terms is known and fixed, as this is measured in terms of itself.

Differences in the liquidity of assets result in differences in demand which otherwise would not exist. If the liquidity of assets were of no importance there would be no demand for money, (except perhaps for the sake of convenience, for transactions purposes) when assets yielding a return could be held instead. Since differences in the liquidities of different asset-types would be eliminated, the demand for the more-liquid, lower-yielding assets would fall. The prices of different assets would be adjusted in such a way that the interest-yield would be identical for all types. In more normal circumstances liquidity differences will exist and will be reflected in differences in the interest-yields on various types of assets. The yield on money is lower than that on securities which in turn is lower than that on the majority of other assets simply because of the differences in the liquidities of these assets. The higher yield on the less liquid assets compensates for their lower liquidity. Thus the interest-yield on securities is an index of the liquidity of that asset.

### C. The Whole Liquidity Position

Money then is the most liquid asset. All assets have a degree of liquidity, some being more liquid than others. We can

talk now of "total liquidity" or the "whole liquidity position" as a theoretical concept which takes into account all forms of assets and their respective liquidities. Further, we can talk of the demand for a total liquidity position. An analysis of the demand for money is an analysis of liquidity preference in the Keynesian sense. However, this demand simply reflects a part of the demand for a total liquidity position. Liquidity preference as the demand for money involves the interpretation of liquidity in a narrow sense. Before examining the demand for money involving the narrow view of liquidity, it may be useful to first look at liquidity in a broader sense - total liquidity. The present section then is devoted to an examination of the factors determining the whole liquidity position, and since this is a feature of the Report of the Radcliffe Committee<sup>14</sup>, the examination will be primarily built around a discussion of the Radcliffe Committee's analysis.

The contention of the Radcliffe Committee is that aggregate demand depends not solely upon the supply of money, but on the "whole liquidity position" of the economy. It is this latter which determines the amount of money the individual thinks he can get hold of, and it is what the individual thinks he can get hold of which influences his decisions to spend. The Radcliffe Committee regards money as important only as a part of the whole liquidity

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14. The Report of the Committee on the Working of the Monetary System (cmd. 827) London, H.M.S.O., 1959.

position. The term "liquidity" is not clearly defined in the Report of the Radcliffe Committee. It appears to be an attribute possessed by different assets in different degrees. By implication the term is being used in a generally accepted sense. Thus the degree of liquidity of an asset is determined by the conditions stated earlier.<sup>15</sup>

Having established the nature of the liquidity of an asset the next step is to see what the Radcliffe Committee meant by the "whole liquidity position". To begin with, the whole liquidity position relates to the total asset holdings of whatever entity is being discussed. Thus, an individual's whole liquidity position is the "total liquidity" of the assets he holds. The total liquidity of this asset holding, or alternatively the individual's whole liquidity position, will vary with the total stock and the distribution of this total between different types of assets with different liquidities. From this it is clear that there are certain complications in observing the total liquidity positions:

1. The liquidity of an asset cannot be measured at a point of time. Discussion of total liquidity and variations in it imply that the liquidity of an asset can be measured in terms of some common unit and that these separate liquidities can then be added for all assets. This would necessitate the measurability of liquidity on some cardinal scale. In fact, there is no method by which liquidity may be directly measured. There is not even

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15. p. 8 above.

any very satisfactory standard to approximate liquidity by indirect measurement. There is no method of measurement which enables us to say with any degree of precision at all that, for instance, asset A has ten points of liquidity, while asset B has only three points. However, we can have some idea of whether asset A is more liquid than asset B, though this would be difficult to ascertain in a marginal case.

2. Even if the liquidity of an asset could be measured at a point of time, an added complication is that the liquidity of the asset will probably vary over time. In fact not only will the liquidity of an asset vary in absolute terms over time, but it may well vary relative to the liquidity of other assets. The Radcliffe Committee recognises the difficulty, when using a number of the most liquid of assets in inter-period comparisons, in making the reservations that "These facts can however be no more than illustrative, as there is no way of equating one asset to another ... We cannot even regard any particular asset as making just the same contribution to liquidity as it made before the war ...".<sup>16</sup>

In the case of the most liquid of assets, conversion into a perfectly liquid form can be achieved in a relatively short space of time, and this factor will remain more or less constant over time. For instance, securities and debentures of all maturities

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16. The Report, para. 473.

are readily marketable under most circumstances - within a day or less. For this class of asset, prices also tend to be relatively stable, but this is the variable factor; the time required to market these assets changes little, while prices do vary though generally without very extensive fluctuations. Thus price changes are the chief source of changes in the liquidity of highly liquid assets. For instance, if the price of an asset falls and the holder is sensitive to capital losses, he will tend to hold that asset, if possible, until the price recovers or alternatively, in the case of dated securities and debentures, until the date of maturity, rather than realise the capital loss. In this manner the formerly liquid asset is now rendered relatively illiquid and hence price changes (i.e. interest rate changes) lead to variations in the total liquidity position of the individual.

3. Changes in the whole liquidity position of the private sector will also occur through changes in the total stock of assets and in the structure of asset holdings. With a given distribution of the stock of assets an increase in that stock will, *cet. par.*, increase total liquidity. On the other hand, with a given stock of assets, a change in the distribution of this stock in favour of the more liquid assets will increase total liquidity also.

It may be noted at this stage that the second and third points relating to the difficulties of measuring total liquidity

are themselves linked. The price at which each asset type may be sold will be determined in part by the total stock of assets and the distribution of that stock between the different types. Thus changes in the stock and distribution of assets, as well as influencing the whole liquidity position directly, will also influence it indirectly by bringing about price changes. Given the prices of assets, an increase in the stock of assets will necessarily increase the whole liquidity position. However, prices will, in fact, tend to fall and this will reduce total liquidity. Similarly a change in the distribution of assets in favour of highly liquid assets will on the one hand increase total liquidity but on the other, through price falls amongst these highly liquid assets, will reduce total liquidity. Changes in the stocks and distribution of assets tend to induce price changes with offsetting liquidity effects. The net effect upon total liquidity will depend upon the sensitivity of prices to changes in the total stock and the distribution of assets.

It can be seen that there are a number of factors complicating the process of measuring the whole liquidity position of an individual or an economy, and making even an approximate measure of the whole liquidity position doubtful. There is no apparent solution to the various problems, so all that can be done is to seek as good an approximation of total liquidity as possible. The commonly adopted procedure, and that used in the Report, is to add the money values of the highly liquid assets, treating them as

of equal liquidity,<sup>17</sup> and ignoring all other assets. Thus certain assets are arbitrarily defined as liquid, and all assets outside that range selected are illiquid. Though admittedly a rough method, the limitation of the whole liquidity position to those assets with a high degree of liquidity seems to be the best approximation that can be made, especially if discussion around the concept is to be kept within manageable limits. Particularly when we are concerned with the empirical observation of liquidity preference it is necessary to compromise the notion of total liquidity and confine the examination to a narrow range of the most liquid assets in order to have a measurable concept. However, what the Radcliffe Committee appears to be concerned with is not precision in the measurement of liquidity, but a knowledge and understanding of the basic components of the whole liquidity position. An understanding of these basic components will yield some insight into the sorts of factors determining the individual's liquidity position.

#### D. Liquidity, Money and Expenditure

The Radcliffe Committee maintains that decisions to spend are related to the whole liquidity position and therefore changes in the whole liquidity position and in the demand for liquid assets are significant. While on the subject of liquidity

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17. The Report. "... in a highly developed financial system ... there are many highly liquid assets which are close substitutes for money, as good to hold and only inferior when the actual moment for a payment arrives". para. 392.

a short digression dealing with the relationship of rates of expenditure and the whole liquidity position may be warranted at this stage.

Let us suppose that the monetary authorities want to restrain expenditure. In this case the appropriate action might be for example to increase sales of government securities. The effect of this action would be to redistribute the asset holding of the private sector in favour of less liquid assets. The supply of money is reduced and correspondingly an increase in the supply of a less liquid asset, government securities, takes place. Further, the open-market operations will probably result in a fall in security prices. If prices are expected to rise again in the future holders of securities will be reluctant to sell because of the capital loss which would be involved. Thus securities will be less liquid than was the case previous to the open-market sales. The total liquidity position of the private sector has been reduced in two ways:

1. by a redistribution of assets in favour of the less liquid assets.
2. by the reduced liquidity of government securities as a result of price falls.

If the monetary authorities had operated by withdrawing money from the banking system by stipulating an increase in the balances of the banks held with the central bank, the result would have been:



1. a reduction in the total stock of assets and therefore of total liquidity, particularly since the assets concerned are the most liquid.

2. probably an increase in interest rates (fall in asset prices) as the banks may sell assets in order to obtain money to meet the central bank's requirements. Similarly with other methods of applying monetary policy the effects will be upon the total liquidity position with associated interest rate changes.

The monetary policy measures outlined operate upon interest rates and total liquidity. The Radcliffe Committee distinguishes between the effects of these two factors as the "liquidity" or "availability" effect and the "interest incentive effect". The latter effect is the one relied upon by Keynes to provide the basis for effective monetary control. The appropriate action by the authorities will increase the interest rate, and this will deter the marginal spender. Investment projects regarded as profitable when the cost of funds required is say three percent may become sufficiently less profitable when the rate of interest is five percent to cause many investors to postpone their investment. The first effect, that of liquidity or availability, is described by Newlyn:<sup>18</sup> "However efficient the monetary system, there must therefore (because a developed economy requires its members to operate in some common medium of exchange) be some finite

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18. Newlyn, W.T. Theory of Money. 1962. p. 162.

limit to the velocity of circulation." and "Expenditure necessarily requires that money shall be provided by someone and the less there is of it in relation to the expenditure being attempted the greater the probability that it will not be available in the place and at the time required." If total liquidity is by some means reduced, funds are not as readily available. Financial institutions become less willing to lend except at higher interest rates, and because many institutional lending rates of interest are "sticky", these institutions tend to ration their funds rather than increase their lending rates. It is for this reason that the availability and incentive effects are distinguished between. When interest rates rise borrowing will fall, not because of an interest-incentive effect, but because the interest-rate rise is associated with a fall in total liquidity, and funds are just not available. As the Radcliffe Committee suggests there may be many unsatisfied borrowers who would be willing to take higher rates, but the institutions have rationed their lending, and funds are not available on the scale demanded at any "reasonable" rate of interest. Briefly this is the availability or liquidity effect. We will return to it again in chapter seven.

A vital question in monetary theory is that relating to the importance and nature of the influence of monetary policy on expenditure. Is liquidity simply a permissive factor relating to expenditure in the sense that total liquidity may be reduced to the extent that many would-be spenders are unable to obtain the

funds required and therefore are not permitted to spend? If this is the case, monetary policy is useful in restraining expenditure but cannot, of its own volition, stimulate an increase in expenditure, but can merely provide some of the conditions necessary for expansion to take place. There is an alternative possibility. If interest rates are influenced by changes in total liquidity then variations in total liquidity may operate upon expenditure as described through the availability effect or through interest rate changes. The question is then raised as to the importance of the interest-incentive effect, and it is widely held that this is of significance only for expenditure decisions relating to long periods of time. If this be accepted, the interest-incentive effect is eliminated as an effective part of monetary policies directed at short-run objectives. However, it must be noted that this does not dismiss interest rate changes in the short-run entirely, as such changes will still have a permissive effect operating through total liquidity. An increase in interest rates makes asset holders unwilling to sell their assets and thereby realise capital losses and consequently total liquidity is reduced. Thus there are two contrasting but not mutually exclusive possibilities. Monetary policy operating upon total liquidity may create a situation which is either favourable or otherwise to increased expenditure, depending upon the availability of funds, and secondly monetary policy may operate upon expenditure by means of the interest-incentive effect.

The Radcliffe Committee regard liquidity as a permissive element in expenditure decisions, and since they also find the significance of the interest-incentive effect limited, particularly in the short-run, monetary policy would appear to be restricted to situations when restraints upon expenditure are required, and is of little value in bringing about of its own volition an increase in activity, although it may be a necessary adjunct to other policies in order to make funds readily available. If a contraction of spending is required, total liquidity can be reduced and the distribution of liquid assets can be altered in favour of those individuals and businesses least likely to increase their rates of expenditure or make funds available to would-be spenders if their liquidity position improves. "There is no magic, fixed relationship between G.N.P. and money supply..... Certainly, any conclusions about adequacy or inadequacy of money supply must take account of the broad array of liquid assets which, while paying interest, are convertible into cash with little inconvenience or risk of loss and reduce needs for currency and checking deposits."<sup>19</sup> It follows then that monetary policy may be used to influence expenditure either by variations in total liquidity or by changes in its distribution between individuals and businesses, and that ideally an analysis of monetary economics

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19. First National City Bank of New York. Interest Rates and Liquidity (in Monthly Letter of the First National City Bank, September, 1962: 100-103). p. 102.

must take into account the supply of and demand for liquid assets other than money as well as money itself. It is the whole liquidity position which is relevant to spending decisions.

E. Money, or the Whole Liquidity Position

If the total liquidity, and its distribution amongst individuals, businesses and financial institutions influences total expenditure either through the availability effect or alternatively the interest-incentive effect, or the two combined, it would be valuable to have information regarding the nature of the demand for this liquidity. We have already considered the difficulties of observing the total liquidity position,<sup>20</sup> and if we cannot observe it then we cannot hope to construct a demand function for total liquidity. The most we can hope to do is to construct a demand curve for a group of assets with similar liquidities and hope that this will tell us something about the demand for liquidity as a whole. Possibly the best group of assets to select would be those at the most liquid end such as: notes and coin and current and savings accounts. The next most liquid assets such as time deposits, Treasury Bills and government securities are to some degree less liquid than money and whether they would in fact be included would depend upon the comparative advantages and disadvantages. What is gained in breadth by their inclusion

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20. pp. 11-15 above.

might be lost in differences in the liquidities of the various asset types. There are a number of points which favour the selection of the most liquid assets although a justification for the precise delineation of a group of assets will not be attempted here.

1. The assets at the most liquid end form a fairly large part of total assets, and certainly form one of the larger groups of assets with a similar degree of liquidity. There are exceptions. For example physical assets undoubtedly form a far larger part of total assets, but this group will be dismissed under the next point. The most liquid assets qualify under this point, but other groups of assets could be selected which would satisfy this condition equally as well or better.

2. The second requirement is that the group of assets chosen should have a high degree of liquidity since we are attempting to get some idea of movements in the whole liquidity position. Assets such as buildings have little relevance for liquidity even though they may constitute a large part of total assets. On the other hand, an asset such as a government security is highly liquid and is significant in relation to total liquidity. Therefore, since we are confined to a group of assets with a similar degree of liquidity, we are, under this second requirement, confined to those assets with a high degree of liquidity.

3. Since we are confined to assets with a high degree of liquidity it seems to be a logical step to concentrate upon those assets within this range which are demanded solely for their

liquidity. If this is done, although we would not be examining the whole liquidity position, at least we would be examining a demand for liquidity alone, freed from the influence of factors other than liquidity which make other assets desirable to hold and which complicate and obstruct the demand picture required.

Thus if we use the quantity of most-liquid assets we not only have a significant part of total assets and a part which is highly liquid, but we have a range of assets which is not demanded for any other aspect than liquidity. Though not a total demand, since many less-liquid assets will be omitted, the demand will be virtually solely representative of the demand for liquidity, either at a point of time or over a period, as the assets considered will be demanded because they are liquid, and for no other reason. An examination of the demand for money should therefore reveal quite a lot about the nature of the demand for liquidity as a whole.

The foregoing implies that the Radcliffe Committee's notion of the whole liquidity position is only an extension of the concept of the demand for money - the real difference between the approaches of Keynes and the Radcliffe Committee lies not in the concepts of money and liquidity, but in their respective attitudes towards the importance of the interest-incentive effect - and in any case the restrictions imposed by an empirical study limit the analysis to a range of assets which is much closer to the Keynesian "money" than the Radcliffe "liquidity". The effective difference between liquidity and money is debatable. It may be

considerable as the Radcliffe Committee suggests on grounds that there are many assets which are close substitutes for money, or it may not be highly significant at all. However, whichever of these viewpoints is correct, an analysis of the demand for money should provide much information about the nature of the demand for liquidity.

The objective of this study is therefore to examine the nature and importance of the demand for money, and in particular to examine the hypothesis that a stable function of the demand for money exists, on the lines adopted by similar studies for other countries,<sup>21</sup> and using Australian data.

#### F. The Demand for Money

The second chapter is an analysis of the theory of liquidity preference presented by Keynes.<sup>22</sup> A relationship between interest rates, income and the quantity of money is postulated and its nature examined. Following along the lines of developments since the General Theory, chapter three seeks other variables to explain and clarify the nature of the demand for money. Empirical tests involving simply interest rates, income or transactions and the quantity of money do not generally reveal a stable relationship between these variables,<sup>23</sup> and strong a priori arguments can be

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21. See chapter 4.

22. The General Theory.

23. See chapter 4.



provided to support significant relationships between the quantity of money demanded and variables other than interest rates and income. For example, variations in the quantity of highly-liquid assets not usually included as money undoubtedly have some influence upon the demand for money, since they are close substitutes for money. If it is the whole liquidity position which is important the volume of highly-liquid assets will certainly be relevant to the demand for money. The possible nature of the demand for money and the repercussions of changes in the supply of money upon levels of employment, output and prices through the relationship of the explanatory variables considered with the demand for money are also examined in chapter three.

Having discussed some of the theoretical positions and possibilities, the processes and results of some empirical analyses seeking to establish a stable demand-for-money function are investigated in chapter four. The analyses conducted over the last two decades have taken many forms, the only common ground of many investigations being the desire to arrive at a stable function by empirical methods. A similar empirical study using Australian data appears in chapter five, preceded by a discussion of some of the limitations of and problems associated with this particular type of empirical research.

The empirical work of chapter five is an attempt on a very limited scale to complement, and in some cases extend, the empirical investigations already conducted for a number of other countries. The purpose of such empirical investigations is to indicate what

sort of support exists for particular monetary policies, and to facilitate an assessment of the relative advantages and attributes of different policy measures, and perhaps to indicate to what lengths measures must be taken to achieve whatever results are desired. The possible implications of the empirical investigations for monetary theory and policy are considered in the following chapters, especially in chapter six which also provides an outline of monetary policy particularly as applied in Australia.

Certainly none of the matters which are considered in the following chapters are dealt with at all fully and many aspects of the subject are necessarily dealt with somewhat cursorily. However, if they do not succeed in resolving all the problems, inconsistencies and controversies involved in monetary theory and policy, they may at least present a complete picture of the field and exhibit a wide range of viewpoints.

The point upon which attention is concentrated throughout is the significance of and need for information about the demand-for-money function, and if possible the derivation of a stable function. There is considerable disagreement over the role played by the quantity of money and its significance and importance for economic policy. The instability of the relationship between the quantity of money and the level of income is readily observable. An explanation of this instability by the derivation of a stable demand-for-money function would enable a more positive and sure control of economic activity by means of monetary policy, or at least a better understanding of its operation. Therefore, this

thesis is primarily devoted to an investigation of the demand for money, and in particular is concerned with empirical tests designed to determine the probable nature of that demand.

## CHAPTER TWO

### THE DEMAND-FOR-MONEY FUNCTION IN THE GENERAL THEORY

#### A. Sources of the Demand for Money

Most of the empirical studies and the theoretical notions behind them examined in chapter four are extensions of the theory of liquidity preference as expressed by Keynes.<sup>1</sup> Therefore it seems appropriate that some of the ideas as they appear in The General Theory should be recorded and examined. Keynes took the quantity of assets held in the form of money by any individual in different sets of circumstances to be the liquidity preference of that individual. As these circumstances alter so will the quantity of money which the individual is prepared to hold. For the greater part of this chapter we will be concerned with discussing what circumstances Keynes considered to be of major importance, and in what way the factors considered to be relevant influence the preference of the individual for liquidity.

#### I. Money as the Medium of Exchange

##### (1) The transactions motive

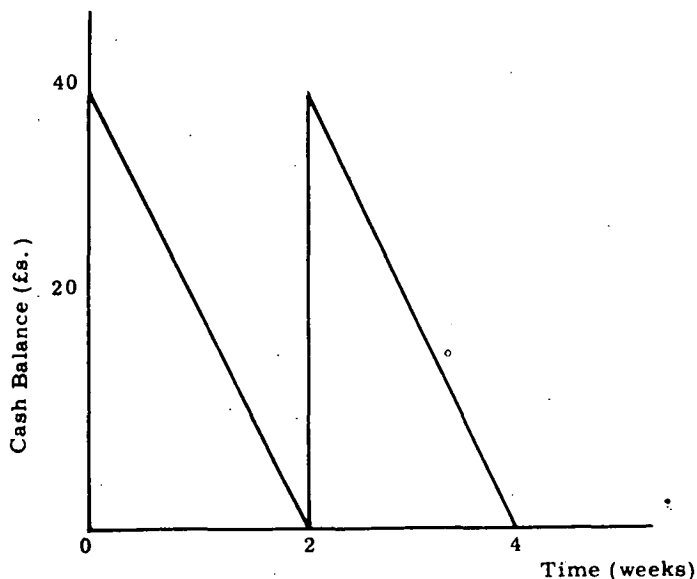
This motive stems from the need to effect personal and business transactions. In the case of the individual there is generally an interval between the receipt of income and the spending of that income, and so at the beginning of the interval (the point

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1. Keynes, J.M. The General Theory of Employment, Interest and Money. 1936.

at which income is received) an amount of money will be held for transactions purposes. The quantity of money held will fall as expenditure takes place over the period, and by the end of the period (when a further income payment is due) the quantity of money held for transactions should be close to zero. As an example, if the income of an individual is forty pounds per fortnight, and assuming that his expenditure is evenly distributed over the fortnightly period and requires all his income, the cash balances which he will be required to hold will follow the time pattern indicated in Figure 1, moving steadily from forty pounds

Figure 1



to zero over each fortnightly period. For a large number of similar individuals receiving their incomes upon different days over a fortnightly period, it can be seen that the cash balance

per head will be twenty pounds at any one point of time. The transactions demand for money is thus the result of the discontinuous nature of income and the continuous nature of expenditure for the individual. For the business the same principle applies, except that in many cases it is receipts which are continuous and expenditure which tends to be discontinuous. For example a retailing firm has sales which vary little from day to day whereas many of its expenditure items such as wages and salaries occur at intervals. There will, therefore, be a tendency for the cash balances of businesses to be run down more quickly on the one hand and augmented more slowly but steadily on the other than is the case for the individual. However, the result will be the same in that businesses will be required to hold cash balances in order to bridge the gap between receipts and payments.

## II. Money as an Asset

The "quantity theory" focussed attention upon money in its role as the medium of exchange. However, Keynes progresses a step further and seeks to establish a demand for money as an asset. He examines two likely sources of such a demand - the precautionary and speculative motives. It is emphasised that money satisfies more than simple transactions needs. Money is an asset and has the attribute of liquidity and since the individual has a liquidity preference this will give rise to a demand for money. Keynes regards the rate of interest as the reward for parting with liquidity. It is only when the future of this rate is uncertain

that money is appreciably more liquid than interest-bearing assets, and therefore only under such circumstances that there will be a demand for money arising from a desire for liquidity.

Liquidity preference will still exist even when the future of the interest rate is completely certain, but under such circumstances the desire for liquidity will not lead to a demand for money, for with complete certainty regarding interest rates, interest-bearing assets which are of a fixed money value become equally as liquid as money. A certain level of liquidity would still be required to satisfy the motives behind liquidity preference, the difference being that a wider range of assets would now be appropriate to satisfy the demand, as assets other than money, such as securities, would be effectively as liquid as money. In fact, amongst the liquid assets there would be a preference for holding securities as against money, unless money were held in the form of interest-bearing deposits which yielded a return comparable with that yielded on securities. If expectations of future rates of interest are completely certain, the relevant assets can be transferred into money at any time on known terms. It is, therefore, the uncertainty of expectations about the bond rate of interest which renders securities less liquid than money.

(1) The precautionary motive

Two definitions of this motive appear in "The General Theory":

(1) "... the desire for security as to the future cash equivalent of a certain proportion of total resources".<sup>2</sup>

(2) "To provide for contingencies requiring sudden expenditure and for unforeseen opportunities of advantageous purchases, and also to hold an asset of which the value is fixed in terms of money to meet a subsequent liability fixed in terms of money ...".<sup>3</sup>

To begin with it is difficult to reconcile the two definitions. The first statement of the precautionary motive indicates that the motive is closely related to total resources, while the second definition has much in common with the speculative motive,<sup>4</sup> particularly the reference to "contingencies" and "unforeseen opportunities of advantageous purchases". The second description of the motive provided appears to be more consistent with a demand for money which is sensitive to variations in either, or both, of the rate of interest and total assets. In the first statement of the precautionary motive the term "total resources" may mean total assets or income, or it could be interpreted as some amalgamation of the two. Thus an interpretation of the precautionary motive in terms of either total assets or income under the first definition, or a description of it as

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2. The General Theory. p. 170.

3. The General Theory. p. 196.

4. p. 33 below.



being of a semi-speculative character under the second definition appear justifiable. However, the situation is clarified in the statement that the demand arising from the first two motives (transactions and precautionary) is insensitive to the rate of interest (and by omission to total assets), being "... mainly a resultant of the general activity of the economic system and of the level of money income."<sup>5</sup>

(ii) The speculative motive

The speculative motive provides the most significant development in the analysis of the demand for money by Keynes. We now have a source of the demand for money which is not related to the level of money income. Since variations in the level of income are generally relatively small, and the transactions and precautionary demands for money are tied to the level of income, these demands provide a fairly stable base to the demand for money. As its name indicates the speculative motive is essentially "... the object of securing profit from knowing better than the market what the future will bring forth."<sup>6</sup> It is apparent that the motive as described will be influenced primarily by asset prices and therefore by interest rates and expectations about them. The speculative demand for money is the most flexible part of the demand for money and the monetary system

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5. The General Theory. p. 196.

6. The General Theory. p. 170.

derives its sensitivity from the marginal effect of the speculative demand - or, to avoid controversies over terminology, the demand for money which is not primarily determined by the level of income. Under Keynes' classification the speculative motive is the only one sensitive to interest rate variations. Brian Tew<sup>7</sup> distinguishes between three types of investor when discussing the sensitivity of the demand for money to changes in the rate of interest. These are: the income-cautious investor, the capital-cautious investor, and the speculator. The income-cautious investor is conscious basically of the return on his investments. If the return on bonds is higher than that on liquid assets this will be sufficient justification for the income-cautious investor to hold bonds in preference to liquid assets. The capital-cautious investor is, similarly, concerned with the income derived from bonds as against money, but he is aware of possible price falls. If the capital-cautious investor expects a fall in the price of bonds, he will probably be induced to sell bonds and increase his money holdings, even though in so doing he foregoes an interest yield. The capital-cautious investor will only continue to hold bonds in the face of an expected price fall if the capital loss involved is offset to such a degree by the interest yield on bonds that the net return on his holdings of bonds is greater than it

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7. Tew, J.B.H. Wealth and Income. 1950.

would be if he held his assets in the form of money. On the other hand, if the capital-cautious investor expects bond prices to remain stable or to rise, he will hold bonds in preference to money. The speculator is concerned not with the interest-income derived from bond holdings, but with capital gains. Therefore, the speculator will be concerned with possible price increases. If the speculator expects prices to rise he will buy bonds; if he expects bond prices to fall or remain stable he will in both cases be tempted to sell any bond holdings he may have, as there is little chance of capital gain. The difference between the two last types of investor is therefore, that the capital-cautious investor will only be inclined to hold money in preference to bonds if he expects a fall in the price of bonds, whereas the speculator will not only prefer money to bonds, when a price fall is expected, but will have no marked preference for bonds compared with money when he expects the prices of bonds to remain stable. It is suggested by Tew that the majority of bond holders will be of the capital-cautious type<sup>8</sup> which would lend more stability to the relationship between money and interest rates. However, basically the operations of both the capital-cautious investor and the speculator will result in a positive relationship between expected bond prices and bond holdings, and similarly for the income-cautious investor, although variations in money holdings

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8. Wealth and Income. pp. 113-114.

of this type of investor will tend to be sensitive to variations in the rate of interest only at low levels of that rate.

B. Factors Determining the Strength of the Motives Behind the Demand for Money

(1) Transactions demand

The strength of the transactions demand for money will vary with a number of factors. For an individual the demand for money for transactions purposes will vary not only with the level of income, but also with the length of the pay interval. Suppose that an individual with a given annual income is faced with two possible pay intervals, one of one week and one of two weeks. If income at a weekly rate is twenty pounds, given the even distribution of expenditure over the period and that his income is wholly consumed, the average cash balances held by the individual over time will be ten pounds. If however he receives his income fortnightly, with the same assumption his average cash balances over time will need to be twenty pounds. For a business the same factors are relevant, and with one or two additions they are applicable for individuals and businesses taken in the aggregate. There is one point in particular to be considered. National income and the total volume of transactions (both measured in money terms) are not identical. A considerable number of transactions would not be included in national income. For instance the purchase of second-hand goods involves cash

transactions but will not result in a change in money national income. The effects of the difference in magnitude between transactions and income will be reduced to the extent that non-cash transactions take place, particularly within business organisations. This is particularly significant in the case of the vertical integration of businesses, for then many transactions are involved and become non-cash transactions.

The more important points influencing the aggregate transactions demand for money other than the level of money national income will be:

1. the difference between money income and the volume of money transactions as just described.
2. the time-distribution of receipts and payments for both individuals and businesses.

On the first point, if we only wish money income to be an index of the transactions demand for money, it will be satisfactory in the short-run. In the long-run institutional change is likely to bring about significant changes in the relative sizes of money income and money transactions. However, at least for short periods of time we can use the level of money income as the sole determinant of the transactions demand for money. The influence of the second point can be dismissed for short periods of time as negligible, although for longer periods changes are likely to occur. For instance, if the interval between the payment of wages is doubled the transactions demand for money will increase,

or if businesses grant credit much more extensively to each other and to individuals the demand for money will be reduced. However, changes of this nature likely to be significant in relation to the demand for money will be unlikely to occur in the short-run.

(11) The precautionary motive

The strength of the precautionary motive will depend partly upon the cheapness and reliability with which money may be obtained, as for example in the form of an overdraft. Cheap, convenient and reliable forms of borrowing will reduce the need to hold cash to meet contingencies. The need to provide for contingencies by holding cash will also be modified to the extent that provision is made for them in other forms, as with insurance against accident or sickness or provisions made by the government for sickness, old age and unemployment. Also the interest foregone on assets by holding money must be taken into account. If there is a high rate of interest, it will be less preferable to hold cash under the precautionary motive, given the terms on which money may be borrowed, than would be the case with low rates of interest, as while money is held, income from assets at high rates of interest is foregone. We can say that, given the level of interest rates and the greater the difficulty of borrowing, the more likely it is that the individual will hold money. Fellner<sup>9</sup> claims that the precautionary motive has more in common

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9. Fellner, W. Monetary Policies and the Elasticity of Liquidity Functions (in Rev. Econ. Stats. Vol. 30: 42-44, 1948).

with the speculative motive than with the transactions motive, maintaining that the precautionary demand for money is interest-elastic and does in fact vary inversely with the rate of interest. However, this is not entirely consistent with the need to take into consideration the ease and cost of borrowing as well as the returns on assets, both of which may well tend to move in the same direction, and therefore the effects of one possibly cancel the other. Keynes concludes that the rate of interest is likely to be a minor factor in determining the strength of the precautionary motive, and instead relates the precautionary motive to the level of money income as he does with the transactions motive.

(iii) The speculative motive

The speculative motive gives rise to a demand for money which is related to interest rates, or at least to expectations about interest rates. As expectations about the rate of interest (bond prices) vary, so the amount of money demanded under the speculative motive will vary. For instance if the rate of interest on long-term securities is four per cent and many individuals expect the rate to increase to five per cent within six months, it will obviously be more desirable to forego the income which could be derived by switching from holding money to securities, because if the expectations of these individuals are fulfilled, the purchase of bonds at a four per cent yield, and having that yield increase to five per cent would involve a potential capital loss far outweighing the gains to income from the interest-yield.

By introducing the concept of normal rates of interest we can talk about movements in interest rates instead of expectations. The notion is clearly stated by Ackley:<sup>10</sup>

"... the particular concepts of normal prevailing at any given time reflect experiences of the immediate and more distant past, as perceived by each individual, modified by any information, reasoning, or hunches that he may have about the way in which the future may differ from the past." Given an individual's idea of the normal rate of interest the level of the current rate relative to it will determine the speculative demand for money by the individual. If, for example, the normal rate is four per cent and the actual rate is five per cent, the individual will prefer to hold assets rather than cash in the expectation that interest rates will fall (and asset prices rise) to their normal level in the near future.

When considering the aggregate speculative demand for money there are two factors to be taken into account:

1. variations in ideas about the normal rate of interest between individuals.
2. for any individual the normal rate is not a precise magnitude and his ideas about it will not be held with complete certainty.

Both these factors will contribute towards a situation where, over a large range of interest rates, there will be some speculative

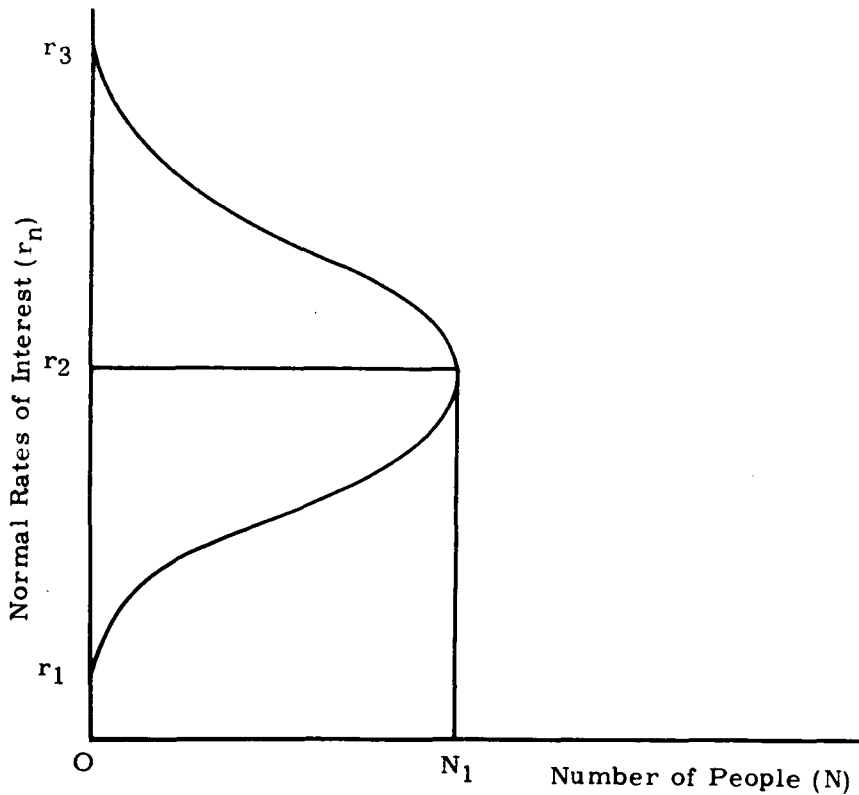
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10. Ackley, G. Macroeconomic Theory. 1961. p. 178.



demand for money. It seems probable that people's ideas about the normal rate of interest will be distributed about some particular rate. Ideas will not correspond entirely for all individuals, but will probably tend to be distributed in the general manner indicated in Figure 2.

Figure 2



At  $r_2$  the largest single group of people ( $N_1$ ) believe that this is the normal rate of interest. At  $r_3$  there is not one person who believes that the normal rate of interest is that high, but as the rate is reduced towards  $r_2$  progressively larger numbers of people are "satisfied". Similarly, as the rate of interest increases from  $r_1$  the normal rates of progressively larger numbers of people are encountered. It is apparent that the wider the distribution of opinions the higher the actual rate of interest will have to be before nobody desires to hold money to satisfy the speculative demand, and the lower the rate will have to be before nobody desires to hold bonds to satisfy the speculative demand. At some rate of interest even the individual with the highest normal rate of interest will be prepared to hold bonds in preference to money. The rate of interest in question is one which would provide a sufficient income to offset the expected capital losses associated with the beliefs of that individual concerning the normal rate of interest.

The second point of uncertainty makes the speculative demand even more flexible with regard to the actual rate of interest. An individual has some rate of interest which he regards as the most probable normal rate of interest and it seems likely that he will regard a range of rates about this rate of maximum probability as possible normal rates of interest. Therefore, even though the actual rate of interest may be slightly in excess of his normal rate of maximum probability, he will not

necessarily convert all his money holdings into bonds in anticipation of capital gains because he is aware of the possibility of the normal rate being higher than his rate of maximum probability. To the extent that this involves a possibility of capital loss by switching into bonds the individual will retain some money holdings. Similarly for individuals in the aggregate a degree of uncertainty regarding normal rates of interest will mean that actual rates will have to be higher than when uncertainty does not exist before the speculative demand for money will be zero, and on the other hand the lower actual interest rates will have to be before the demand for bonds becomes zero.

The greater the degree of uncertainty about the normal rate and the greater the range of opinions concerning the normal rate, the less sensitive the speculative demand for money will be to changes in the actual rate of interest. An extreme example of the sensitivity which would result without the two moderating factors is when there is complete unanimity and complete conviction concerning the normal rate of interest. Under these circumstances if the actual rate of interest is sufficiently lower than the normal rate for expected capital losses to offset the income-yield there will be a mass movement into money. If the actual rate of interest is above the rate required to produce such a mass movement, there will be a zero demand for money under the speculative motive.

It can be seen then that the strength of the speculative demand for money depends upon the divergence of opinions about

the normal rate of interest and the degree of certainty with which these opinions are held on the one hand, and upon the actual rate of interest on the other.

©. The Nature of the Demand-for-Money Emotion

The separation of those money holdings attributed to the speculative motive and those attributed to the precautionary and transactions motives will facilitate the discussion at this stage and further highlights the role of the speculative motive in the flexibility which it gives to the relationship between the quantity of money and the level of money income.

In an analysis of the demand for money, the separation of cash held for speculative reasons and cash held for non-speculative reasons may be treated as a reasonable approximation of reality, though probably no clear-cut distinction is made by the individual between balances held to satisfy the two sets of motives. On this point Keynes comments that "Whilst the amount of cash which an individual decides to hold to satisfy the transactions-motive and the precautionary-motive is not entirely independent of what he is holding to satisfy the speculative-motive, it is a safe first approximation to regard the amounts of these two sets of cash-holdings as being largely independent of one another."<sup>11</sup>

The demand for money as outlined to date in this chapter

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11. The General Theory. p. 199.

may be stated symbolically:

$$M = L = L_1 + L_2 \quad \dots \quad \dots \quad (a)$$

$$L = f_1(PY) + f_2(r) \quad \dots \quad \dots \quad (b)$$

where:

M is the supply of money

L is the total demand for money consisting of the transactions and precautionary demands ( $L_1$ ) and the speculative demand ( $L_2$ )

Y is the level of real income

P is the price level

r is the rate of interest

$f_1$  is a function of money income and indicates what the demand for money under the transactions and precautionary demands will be at any level of money income

$f_2$  is a function of the rate of interest and reveals for any level of the rate of interest what the speculative demand for money will be.

Equation (b) gives the demand for money while (a) gives the equilibrium of supply and demand. It is implied therefore that there is some mechanism which will bring about equilibrium although it will not be discussed here.

Money held to satisfy the transactions and precautionary motives, which are related to the level of money income, is often

referred to as "active balances". Money held to satisfy the speculative motive is referred to as "idle balances". When either of these terms is used it will be in the sense just described. At this stage the factors that determine the shape of the functions  $f_1$  and  $f_2$  will be examined.

#### I. The Nature of the Demand for Active Balances

The demand for active balances, particularly that relating to the transactions motive, is likely to bear a fairly constant relationship with the level of money income in the short-run. When income changes occur, the quantity of money demanded to satisfy the needs of transactions will vary in fixed proportion with the volume of transactions measured in terms of money. For instance, income changes may involve changes in  $L_1$  of one-tenth of the size of income changes. The proportion of  $PY/L_1$  is ten in this instance and is generally referred to as the income-velocity of circulation of active balances. In the long-run there are likely to be changes in many factors such as social and business habits, the nature of banking and industrial organisations and other institutional changes which will lead to variations in the desired income-velocity of circulation of active balances. In other words changes in the demand function for active balances appear likely in the long-run. Therefore, because it is regarded as a constant linear function, the Keynesian function of the demand for active balances is by implication a short-run function.

## II. The Nature of the Demand for Idle Balances

In the case of the second function,  $f_2$ : "What matters is not the absolute level of  $r$  but the degree of its divergence from what is considered a fairly safe level of  $r$ "<sup>12</sup> the safe rate of interest being that rate which is regarded as normal by the aggregate of individuals in the market. The term normal is being used here in the same sense as described earlier.<sup>13</sup> Several reasons are given to support the thesis that the rate of interest and speculative money holdings are inversely related.

Firstly, if the normal rate of interest is constant - as is likely in the short-run - then every fall in the market rate of interest reduces this rate relative to the normal rate. Therefore, the risk in holding interest-bearing assets is increased under such circumstances, because a future rise in the rate of interest, involving potential capital losses, will appear more likely. Thus if expectations are generally in favour of a rise in the rate of interest, the liquidity of securities is reduced (people will be less inclined to regard securities as an alternative form of liquidity to money), and every fall in the actual rate relative to the normal rate gives rise to such expectations. The relationship of the demand for idle balances, actual interest rates and the

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12. The General Theory. p. 201.

13. pp. 40-44 above.

normal rate of interest has been discussed extensively earlier in this chapter<sup>14</sup> so the argument will not be pursued any further at this stage.

Secondly, every fall in the rate of interest reduces the cost of holding money, and the reward for parting with liquidity, and therefore the less inclined people will be to hold interest-bearing assets in preference to holding money. For instance, an individual is less likely to hold idle balances when the rate of interest is six per cent than when it is two per cent, and so the aggregate demand for idle balances is likely to be much smaller at the former rate of interest.

For these two reasons relating to expectations and the cost of holding money, given the beliefs regarding the normal rate of interest, the liquidity function  $f_2$  will be such that money-holdings not required under the transactions or precautionary motives, and the rate of interest will be inversely related. The function will indicate a determinate rate of interest for any quantity of idle balances, or vice versa.

In addition to the property of inversivity of the liquidity function,  $f_2$ , there are several additional properties which are to be discussed. Keynes postulates that the interest-elasticity of the demand for money approaches infinity at low rates of interest. This property is often referred to as the "liquidity

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14. pp. 40-44 above.



trap". As the rate of interest falls it coincides with fewer people's ideas about the normal rate of interest. When very low levels are reached there will be few people, if any, who believe the normal rate to coincide with the actual rate, and there will be many who believe the normal rate to be considerably higher than the actual rate. For the latter group of individuals the possibility of capital losses will be high and therefore there will be a strong preference for idle balances rather than interest-bearing assets; an effect offset only by the relatively weak asset-demand of the few who regard the low actual interest rate as approximating to the normal rate of interest. There must be a rate of interest which is so low that because of the considerable risk of capital loss, and the small reward for parting with liquidity no matter how much money holdings are increased, individuals cannot be induced to increase their interest-bearing asset holdings and prefer instead to increase their idle balances. The point can be clearly seen in an extreme case where the rate of interest merely covers taxation on the interest-income and the costs of obtaining and holding interest-bearing assets as opposed to money. In such a case the rate of interest would be positive, but there would be no effective reward for parting with liquidity, and risks of capital loss would be extremely high. At this point, if not before, the interest-elasticity of the demand for money would be infinite. Large increases in the quantity of money would have no effect on the rate of interest. The closer the rate of

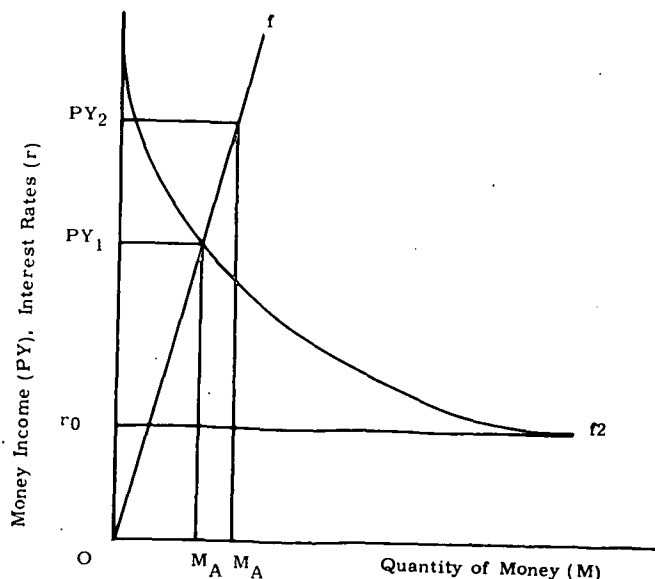
interest becomes to the "floor" rate of interest, the more elastic the demand for money will be in relation to changes in the rate of interest.

On the other hand, as interest rates become higher, the change in the quantity of money demanded relative to any given change in rates of interest will become smaller. The higher the rate of interest, the greater the reward for parting with liquidity and the greater the possibility of capital gain, or the less the risk of capital loss involved by holding interest-bearing assets. Therefore, as interest rates rise, money holders will be induced to part with some of their money in exchange for interest-bearing assets. However, this procedure cannot continue indefinitely as the quantity of money is limited. No interest rate would be sufficiently high to tempt people to further reduce their holdings of money under the speculative motive once these had reached zero, as it would be impossible to do so, unless the income-velocity of circulation of active balances could be increased or the level of money income reduced, thereby enabling a reduction in the quantity of money held to satisfy the transactions and precautionary motives. Thus the demand for money to satisfy the speculative motive will fall as interest rates rise, and when money holdings other than active balances have reached zero the demand for money will be completely inelastic to further interest rate rises. At this stage, all individuals will believe that if any movement is going to take place in the rate of interest it

will be a fall, so that no individual is prepared to hold money in preference to securities.

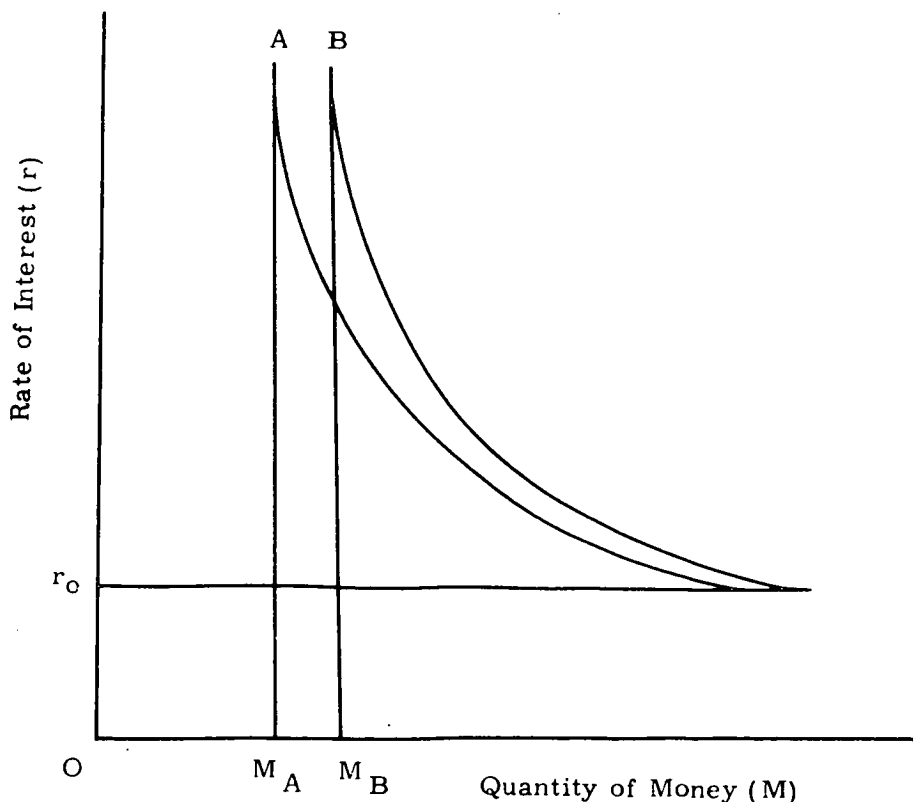
Having described the nature of the demand-for-money function it can now be represented diagrammatically. The demand function for active balances as a constant proportion of money income is illustrated in Figure 3 by the curve  $f_1$ . The demand function for idle balances is indicated by  $f_2$  in Figure 3, and reveals an inverse relationship between the rate of interest and the quantity of money demanded. Also the curve, of a hyperbolic shape, reveals the liquidity trap as described, with  $r_0$  as the floor rate of interest, and the inelasticity of the demand for idle balances as interest rates reach high levels.

Figure 3



The composite demand curve for money will take the form indicated by the curve A in Figure 4 and shows the associated changes in the level of the rate of interest and the quantity of money. The level of income is taken as given. Variations in the level of income simply shift the curve to the right or left. For example, curve B, to the right of curve A, corresponds to a higher level of money income than does curve A. The demand for active balances differs between the two by the horizontal distance  $M_A M_B$ ; the distance  $OM_A$  being the demand for active balances for curve A where the level of money income is  $PY_1$ , and similarly for curve B, the distance  $OM_B$  is the demand for active balances at a level of money income  $PY_2$ .

Figure 4



D. Effects of Changes in the Quantity of Money on Income

Having outlined the nature of the demand for money as postulated by Keynes we will now see its relevance to changes in the level of money income. It will be more meaningful if the examination is pursued in terms of the complete model presented by Keynes.

(i) The complete model

$S$	$=$	$I_1(Y)$	...	...	1
$I$	$=$	$I_2(r)$	...	...	2
$L$	$=$	$I_3(PY, r)$		...	3
$L$	$=$	$M$	...	...	4
$S$	$=$	$I$	...	...	5

where:

$S$  is planned saving

$I$  is planned investment

$L$  is the quantity of money demanded

$r$  is the rate of interest on bonds

$P$  is the general price level and is regarded as a datum

$Y$  is the level of real income

$M$  is the quantity of money

Using this model there are three possibilities to be tested.

An increase in the quantity of money is consistent with:

1. an increase in the level of income?
2. no change in the level of income?
- and 3. a fall in the level of income?

1. If income increases, savings must increase also through the savings function, and this must be accompanied by an increase in investment to maintain the equality of  $S$  and  $I$ .

However planned investment will only increase according to the investment function if the rate of interest falls. Since a fall in the rate of interest is consistent with a rise in the demand for money then an increase in income is also consistent within the framework of the model with an increase in the quantity of money.

2. An increase in the quantity of money is accompanied by an increase in the demand for money. If income does not change, the rate of interest must fall to satisfy the liquidity function. A fall in the rate of interest leads to an increase in investment. To satisfy the model savings must increase, but under the savings function this necessitates an increase in income which is contrary to the original hypothesis. Therefore an increase in the quantity of money accompanied by a constant level of income is inconsistent with the model.

3. If income falls, through the first function savings must fall and therefore investment also falls. This requires an

increase in the rate of interest to satisfy the investment function. An increase in the interest rate together with the stipulated fall in the level of income is associated, via the liquidity function, with a reduction in the quantity of money demanded. If we hypothecate an increase in the quantity of money the fourth condition of the model, the equality of  $L$  and  $M$ , is not satisfied. Therefore the possibility that a decrease in income and an increase in the quantity of money are consistent with the conditions of the Keynesian model must be rejected.

We can say generally that any disturbance from equilibrium will be corrected by those changes in income and the rate of interest, given the level of prices, which will alter the demand for money in such a way as to equate supply and demand, and which will also lead to changes in savings and investment appropriate to their equality. In relation to the demand for money function any excess of demand over supply will be corrected, given the supply, by increases in income and reductions in the rate of interest.

#### (11) Some qualifications

There are a number of qualifications to be made to the general conclusions to be drawn from the model. Keynes suggests two:

1. The liquidity trap
2. Changes in the demand-for-money function.

A further qualification of temporary departures of actual money

holdings from desired money holdings due to frictions is postulated by Friedman.<sup>15</sup> However, only the first two points will be elaborated here while discussion of the last qualification will be left until chapter five.

### 1. The liquidity trap

In a situation where interest rates are very low we have seen that the demand for money will be very elastic to changes in the rate of interest, and the extreme position is one in which the demand for money is infinitely elastic to changes in the rate of interest. In such a situation if the supply of money were increased the increase would be absorbed without any change in the rate of interest and because of this, no change in investment and therefore savings or income would result. The rate of interest is so low that people are prepared to hold any quantity of money in preference to interest-bearing assets. Thus in the limiting case of the liquidity trap, interest rates do not fall nor does income rise as a result of an increase in the supply of money. It may be noted that a problem is posed for monetary policy if it is aimed at the expansion of employment and income in such a situation. However, discussion of this aspect will be left to chapter six.

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15. Friedman, M. The Demand for Money: some Theoretical and Empirical results (in J. Pol. Econ. Vol. 67: 327-357, 1959).



## 2. Changes in the demand-for-money function

The type of change indicated involves a shift in the liquidity function which may be avoided in many instances by the incorporation of other variables in the function. It is under this head that the justification of the introduction of other explanatory variables to supplement those used by Keynes is to be found. The usefulness of the function is thereby enhanced in the empirical field, both for predictive purposes as the more relevant variables included in the function, the more stability it will have, and also in the field of monetary control, because a knowledge of what other variables influence the demand for money may shed more light on the effectiveness of different methods of implementing monetary policy. Elaboration of this subject is undertaken in the following chapter. This type of change contrasts with that outlined on the two previous pages which simply involves movements along the liquidity preference schedule. We have seen that this schedule reveals an inverse relationship between the quantity of money and the rate of interest with an increasing interest-elasticity of the demand for money as the rate of interest falls, while income will be positively associated with changes in the quantity of money. The introduction of possible shifts in the function complicate this picture. For instance, if the liquidity preference schedule shifts upwards and to the right there will be a greater demand for money at any

given rate of interest, so if the quantity of money does not change the rate of interest will rise. As a result the level of investment and income will tend to fall. Thus within the Keynesian model changes in interest rates and the level of income may occur through the liquidity preference schedule not only as a result of changes in the quantity of money but also as a result of shifts in that schedule due to factors external to the model. Some of the possible sources of shifts in the schedule will be considered in the following chapter.

In this chapter we have examined the sources of the demand for money and the nature of the function of the demand for money as postulated by Keynes. As outlined, the variables related to the demand for money are the level of money income and the rate of interest, the former being positively related to the quantity of money demanded, and the latter having an inverse relationship. Further, the lower the level of the rate of interest the greater the elasticity of the demand for money to changes in it. The influence of changes in the quantity of money on the level of income, operating through the function of the demand for money was examined within the framework of the complete Keynesian model. It was seen that with some qualifications an increase in the quantity of money was consistent with a rise in the level of income.

The demand for active balances and the demand for idle

balances are examined separately. Emphasis is placed upon the demand for idle balances, not because the quantity of money held to satisfy this motive is necessarily the most important in magnitude, but because it is the most variable portion of the total quantity of money held since under most circumstances changes in the level of money income will take place fairly slowly through time whereas the quantity of money is subject to relatively greater variation. Keynes argues that investment expenditure is sensitive to changes in the rate of interest and because the demand for idle balances and the rate of interest are related, therefore it is through the demand for idle balances that monetary management operates. Cash requirements under the transactions and precautionary motives are determined by the level of income, and changes in the quantity of money affect income primarily through interest rates. Thus the important function for purposes of monetary control is that of the demand for idle balances whereby rates of interest, and hence income-generating expenditure are influenced. Therefore in the remainder of the analysis we will be concerned particularly with the nature of the demand for idle balances.

## CHAPTER THREE

### EXTENSIONS OF KEYNES' DEMAND-FOR-MONEY FUNCTION

#### A. Introduction

The simple demand schedule for money postulated by Keynes takes the form of a relationship between money, interest rates and income. Keynes discusses changes in the quantity of money demanded resulting from movements along this schedule. Thus, corresponding to changes in the quantity of money demanded there will be appropriate changes in the level of interest rates and income. The quantity of money demanded can also change as a result of a shift in the demand schedule without any change in the two variables interest rates and income. Such shifts in the demand schedule will be the result of changes in other explanatory variables. It is these variables and the nature of their relationship with the demand for money which are to be the subject of this chapter. The ultimate aim is to incorporate in the demand schedule for money those variables which appear relevant to an attempt to clarify the nature of the demand for money and to obtain a better insight into those changes in the quantity of money demanded which Keynes attributes to shifts in the schedule.

The particular variables generally regarded of greatest importance and to be considered here are: highly liquid assets (money substitutes); total assets (money complements); price

levels of physical commodities; and finally non-specific variables such as the tastes and habits of individuals. The relationship of these variables to the demand for money has been considered by a number of writers, and although the list of variables to be examined is not a comprehensive one, it includes all the variables which appear to be most closely related to the demand for money, other than the level of income and interest rates which have been discussed already.

It will be useful to continue the distinction made in the previous chapter between active and idle balances. Active balances are those money balances which are held to satisfy the transactions motive, to meet the needs of personal and business transactions. As described in the previous chapter,<sup>1</sup> the level of income will determine the demand for active balances, given the "normal" or "institutional" income-velocity of circulation of money for the community in question, which is determined by the customs and institutional arrangements associated with, and providing for the exchange of goods and money. Assuming that the normal income velocity is fairly constant, then for any level of income in money terms over a stated period, there will be a specific quantity of money which will satisfy the demand for active balances. One of the factors therefore which will influence

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1. Chapter 2, p. 46.

the demand for money is the level of money income. That part of money holdings treated as active will thus move positively and in close association with money income.

Idle balances will consist of all money holdings which are not required for active balances. Unlike the demand for active balances, there are a number of factors which influence the demand for idle balances. The one receiving the most attention from Keynes is the rate of interest. The postulated relationship between the demand for money and interest rates is an inverse one, with the elasticity of the demand for money increasing as the rate of interest falls.<sup>2</sup> Now we turn to an examination of the other factors which may influence the demand for idle balances.

## B. Other Explanatory Variables

### I. Highly liquid assets

The bulk of assets included here will consist of short-term government securities with Treasury Bills as the most liquid. Such assets are readily marketable and suffer little variation in price. As an example, if the prices of long-term securities fall to such an extent that the yield calculated at market prices is increased by one per cent, other market rates will tend to follow. If we assume that the yield on a security which reaches maturity in one year also rises by one per cent, the price fall resulting will be much smaller than in the case of the long-term securities.

If the rise in the yield on securities with one year to maturity is from three to four per cent, and the price of the security to give a yield of three per cent is at par (one hundred pounds), in order to give an effective yield of four per cent the market price will have to fall to approximately ninety-nine pounds. In contrast a security maturing in five years and yielding five per cent as compared with a former four per cent will have suffered a price fall of approximately five per cent from one hundred to about ninety-five pounds. The price at maturity is discounted back over the intervening period to the present. The rate of discount must be sufficient to give the desired increase in the effective yield of the asset. The longer the time interval before the asset reaches maturity, the greater the rate at which its price at maturity must be discounted in determining its current price in order to achieve a given increase in its effective yield. It can be seen therefore that short-term securities are not subject to price fluctuations of the order experienced by long-term securities.

Unless extreme interest-rate changes are experienced, short-term securities are not a great deal less liquid than money. The interest-yield on short-term securities is generally low, relative to that on long-term securities, so that such assets will be held primarily because of their high liquidity, and only secondarily for the income derived from them. Idle balances are demanded purely because of the liquidity of money, and if

there are some assets which are almost as liquid, but not quite sufficiently liquid to be classed as money, they should act as close substitutes for money. There should therefore be a demand for highly liquid assets as a substitute for money. If the quantity of money is reduced below the quantity demanded, the resulting excess demand may be satisfied in the form of money substitutes, and so the demand for highly liquid assets will increase. Thus, as suggested by the Radcliffe Committee,<sup>3</sup> as the volume of money substitutes increases, so the demand for idle balances will decrease. Highly liquid assets are as good to hold as money almost up until the time of payment, since at any time they can be converted with little delay and with little uncertainty regarding the price. Therefore, highly liquid assets should prove good substitutes for money, so that as the quantity of highly liquid assets increases, the quantity of money demanded should fall, *cet. par.*, holders of money exchanging part of these holdings for highly liquid assets.

## II. Total Assets

An inferior good is one of poor quality which may be bought when incomes are low, but when individuals can afford it they will tend to substitute other more expensive but more desirable goods

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3. The Report of the Committee on the Working of the Monetary System. (Cmd. 827) London, H.M.S.O. 1959.



for it. For example at a very low income level an individual may be forced to rely upon bread as his main source of food. However, as his income increases there will probably be some substitution between bread and other foods as he seeks a more varied diet, and his rate of bread consumption will fall. Consequently the demand for bread will have a negative income elasticity above certain low income levels. Inferior goods may be not only goods of a poor quality but may be "... badges of low social status"<sup>4</sup> so that as an individual is elevated to a higher income level he will reduce his purchases of inferior goods in his adoption of a new social status.

An analogous notion is that of an inferior asset. As suggested by Bronfenbrenner and Mayer,<sup>5</sup> money may be an inferior asset which people seek to hold less of as their total wealth increases. Although this is quite plausible, it is equally plausible, if not more so, that money held in the form of idle balances is a superior asset which people will indulge in increasingly as their wealth increases, and so money holdings will increase with, and at a faster rate than, total wealth.

It is probable that individuals on low incomes, if they hold assets at all, will hold them in the form of money.

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4. Selden, R.T. Monetary Velocity in the United States (in Studies in the Quantity Theory of Money. M. Friedman (ed.) 1956). p. 206.

5. Bronfenbrenner, M. and T. Mayer. Liquidity Functions in the American Economy (in Econometrica. Vol. 28: 810-834, 1960).

The wealth of such an individual is likely to be very limited and it may be insufficient for him to obtain a satisfactory asset, or if it is the expected returns on the asset may not compensate for the trouble and inconvenience involved in purchasing the asset. This is particularly true when bank interest rates can be earned on money in savings deposits. For individuals and businesses whose total assets are very large the desire to hold money may be weak since they are probably able to borrow funds quite readily at reasonable interest rates being in a position to satisfy the credit-worthiness requirements of lending institutions. If we consider these two groups - the small and the large asset holders - the possibility of a negative asset elasticity of the demand for money can be supported. However, the same arguments cannot be used to show that the holder of a significant but not large quantity of assets will tend to hold either all his assets in the form of money or all his assets in less liquid form. Therefore, the argument will not support the thesis that money is an inferior asset for individuals in the aggregate. The inferior asset suggestion by Bronfenbrenner and Mayer was an attempt to provide a justification for their empirical results which unexpectedly revealed a negative relationship between money holdings and total wealth, and they make little attempt to find support for their suggestion on theoretical grounds.<sup>6</sup>

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6. Liquidity Functions in the American Economy. p. 818.

A superior good is one which is considered desirable, but not essential, and consequently has a positive income elasticity of demand. The demand for a superior good would fall to zero at low income levels, but would expand at a faster rate than income as income rose above this level. Speaking loosely a superior good is a luxury good. Correspondingly we may have superior assets. We have seen that the person whose asset holding is very small may be inclined to hold all his assets in the form of money, and his asset holding is likely to be so small that there is no other course open to him. There is no reason apparent to suggest that people with average or large asset holdings will hold a greater proportion of their assets in money form as their total assets increase, although for the individual with a large holding it is a possibility, since the cost of expanding his money holdings will perhaps be significant in absolute terms, but in relation to his income may not be worth considering. Thus the wealthy individual or business, if there is some reason to justify large money holdings, is in a position where the factors operating against such large holdings of money are weak. However, we can hardly say that there is strong evidence here to support the case for money as a superior asset. In fact it may well be that money is neither an inferior nor a superior asset, and that money holdings will increase or decrease at the same rate as the changes which take place in total wealth. There is good reason to suppose that this is the case.

The notion that total assets and idle balances are positively related stems from the notion of a balanced investment portfolio. The individual tends to hold assets covering a wide range of asset-types, from very illiquid and high-yielding assets through the more liquid assets, to the most liquid of all - money. The division of total assets into idle balances and assets of different income-earning forms enables the individual to strike, as Khusro puts it, "... a convenient balance between the alternative ends of profitability and liquidity."<sup>7</sup>

Lydall<sup>8</sup> suggests that the ownership of most types of asset involves the owner in a contingent liability, and that this will give rise to a demand for money which varies positively with the size of total asset holdings. For example, owners of real estate face the possibility of large expenditures on repairs and maintenance, and the scale of such potential expenses will vary with the amount of real estate concerned, given its physical condition. Again, businesses, as owners of capital, may need to finance an unforeseen expansion in stocks, higher wages and maintenance or replacement of equipment. Further, owners of shares which are not fully paid up may be called upon at any time for the balance, or some part of it, or alternatively owners of shares may be presented with opportunities for profitable

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7. Khusro, A.M. An Investigation of Liquidity Preference  
(in York. B. Vol. 4, No. 1: 1-20, 1952). p. 10.

8. Lydall, H.F. Income, Assets and the Demand for Money  
(in Rev. Econ. Stats. Vol. 40: 1-14, 1958).

capital transactions which can only be exploited if funds are readily available. These factors give rise to a demand for money and liquid assets, as in all cases readily available funds are required, which effectively means that idle balances or liquid assets must be held to allow for the contingent liability incurred in the ownership of assets. Thus the amount of money or the quantity of liquid assets required for such contingencies will depend basically upon the size of total asset holdings, so that as the volume of total assets varies so the volume of money required will vary, and in the same direction. This is the demand for money which Keynes appears to be indicating under the precautionary motive. The precautionary motive is linked with total resources, and a further comment on the motive by Keynes refers to provisions for contingencies and advantageous purchases.<sup>9</sup> The description of the precautionary motive in this manner points towards an association under the precautionary motive of the demand for money and total assets, which contrasts with the association of the demand for money and the level of income under the precautionary motive which is the conclusion drawn by Keynes. It appears that, however the motive is to be described, there does exist on a priori grounds a connection between total assets and the demand for money, and that the justification for this relationship is to be found in

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9. See previous chapter, pp. 31-33.

the sorts of factors described in Keynes' precautionary motive.

Lydall proceeds to develop a theory of the demand for idle balances based primarily on the asset-demand for money described above. The schedule of the demand for money is given by:

$$M = M_1 + M_2$$

$$M_1 = c Y$$

$$M_2 = d A$$

where:

M is the total demand for money

$M_1$  is active balances

$M_2$  is idle balances

Y is the level of income

A is the total value of all assets

c is the income-velocity of circulation of money

With the values of Y, c and d specified, an increase in M will involve an increase in total assets if the equilibrium condition  $M = M_1 + M_2$  is to be satisfied. Lydall suggests that the necessary adjustment in the money value of total assets will take place by means of increases in the prices of assets. If in an initial state of equilibrium the quantity of money in the system is increased, the public will be holding a quantity of money, in the form of idle balances, in excess of the quantity which corresponds to the value of total assets, then there are

two possibilities:

1. If the monetary authorities withdraw money from the economy by selling securities, the demand for and supply of money will return to equality by the removal of the appropriate quantity of money from the system, and an increase in the total assets of the private sector.

2. If on the other hand, the monetary authorities keep the quantity of money constant, the attempt by individuals to reduce their money holdings by buying assets will cause an increase in asset prices. This process will continue until an asset-price level has been reached where the money value of total assets is such that idle balances are once again consistent with the demand-for-money function.

It may be noted that the price level rise resulting in the second case involves a fall in the rate of interest. Thus Lydall presents an explanation not only of the demand for idle balances, but also of an inverse relationship between interest rates and idle balances on the basis of his asset demand. According to Lydall's estimates, about fourteen per cent of total assets are held in liquid form (money or "near-money") in the U.K.<sup>10</sup> after deducting active balances. In Australia the income velocity of circulation of active balances -  $\frac{Y}{M_1}$  - for the post-war period is estimated at about eight in chapter five.

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10. Income, Assets and the Demand for Money. See p. 10.

The figure for gross national product for 1961-1962 is £7,327m.<sup>11</sup>

Using these figures active balances are estimated at £916m.

The volume of money for the June quarter of 1962 is £3,918m.<sup>12</sup>

Therefore, idle balances are estimated at about £3,000m. If we assume that the same estimated relationship exists between total assets and money as in the U.K., and if we take idle balances to be £3,000m. as estimated, the total value of assets should be  $\frac{£3,000 \times 100}{14}$  m, or £21,430m. The effect of a ten per cent increase in the supply of money (which is historically a very large change, most annual changes being of the order of three per cent or less) is to increase the money value of total assets by ten per cent to £23,570m. in order that the ratio of idle balances to total assets be kept at fourteen per cent (ignoring for the moment the existence of other liquid assets than money). With the assumption that the physical volume of assets remains unchanged, the prices of assets in the aggregate will have to rise by ten per cent. In other words, an asset formerly yielding five per cent per annum will now yield only  $4\frac{1}{2}$  per cent, provided that the income from the asset remains constant. In the case of a perpetual security yielding 5%, a 10% price increase will have this effect as the price will simply rise by

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11. Quarterly Estimates of National Income and Expenditure.  
Commonwealth Bureau of Census and Statistics.

12. Reserve Bank of Australia Report and Financial Statements  
1962.



10% and the yield fall by 10%. However, in the case of assets which have a specific life, and mature at some specific date, the yield will fall by more than 10% following a 10% price increase. If we take a government security maturing in ten years for which the price has increased from £100 to £110, anyone purchasing that security is going to suffer a capital loss of £10 at the end of the ten year period, which, if averaged out over the period, will involve approximately a loss at the rate of 1% per annum. Thus, in this case the effective yield will fall from 5% to  $3\frac{1}{2}\%$ . Since only some assets reach maturity, and those that do may do so in many cases after a period of considerably more than ten years, the aggregate effect of that group of asset maturing at a specific date will be to reduce the "average yield" on all assets, but not nearly to the extent of a drop from 5% to  $3\frac{1}{2}\%$  as in the example above.

Of course Lydall includes in the group of liquid assets not only money, but also near-money, and it is the total of these two which forms a ratio of fourteen per cent with total assets. As the money supply increases by a certain percentage, if the supply of near-money remains constant, the increase in total liquid assets will be a smaller percentage increase than that of the money supply. Thus the increase in the money value of total assets will be less, and consequently the fall in interest rates will be smaller. The larger the share of

near-money in the total of liquid assets, the less responsive will be interest rates to changes in the money supply without changes in the quantity of other liquid assets. However, this damping effect is offset by the effect already examined of the larger change in yields which will be associated, given the price changes, with dated assets than with assets which do not have a fixed maturity date. The net result may well be that, although changes in the quantity of money have to be relatively greater than the changes they induce in the money value of total assets, the interest rate change associated will be of the same order as the change in the money supply. If this is the case, Lydall's argument implies that large changes in the supply of money will be required to bring about significant changes in interest rates.

Although he does not dismiss the speculative motive entirely, Lydall states that "... the speculative motive is seen to play a much less important role in explaining the demand for money than in the form in which Keynes expounded it" and continues to express doubt that "... the speculative motive makes a great deal of difference to the plot."<sup>13</sup> However, it is difficult to believe that the relationship between idle balances and the value of total assets is sufficiently sensitive and

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13. Income, Assets and the Demand for Money, p. 9.

mechanistic in nature to provide anything approaching a complete explanation of the method by which the demand for money is equated with the supply and the nature of the adjustments which are made in response to a change in supply in order to achieve this equality.

Certainly the fact that an asset demand for money as described probably exists, is not in itself sufficient reason for the rejection of the speculative motive. Both notions appear to be reasonable hypotheses. Lydall has not proved the speculative motive to be non-existent, or virtually so, by his presentation of a theory of an asset-demand for money. However, he has indicated, and with some justification, that Keynes may have over-emphasised the importance of the speculative motive to the exclusion of other possibilities. Lydall, while emphasising the omission by Keynes of other variables appears in danger of succumbing to the same temptation in relation to his asset demand. There is no need to regard the asset-demand and the speculative demand as alternatives between which a choice must be made. The two hypotheses are not mutually exclusive, and the role of each may in fact be significant, though which is the more important can only be determined empirically.

The important feature of the analysis is the positive association of the demand for money and the value of total asset holdings. The value of total assets can vary either through price changes both in the short-run and the long-run, or through

changes in the physical quantity of assets in the long-run. The effect of changes in the physical quantity of assets will result in no more than a gradual and steady movement in the demand for money. However, the influence of price changes whether autonomous, or induced by changes in the quantity of money and other liquid assets, will be of greater significance, the prices of assets being capable of considerable variations over relatively short periods of time.

### III. The price level

#### (i) Its influence

Another variable related to the demand for money is the "level of prices".<sup>14</sup> An increase in the price level will have two effects. The first is to lower the real value of total money holdings. If a community is in a position where the demand for and supply of money are equal, and an autonomous rise in the price level occurs without any change in the demand for money in real terms, the demand for money in nominal terms will increase. This appears to be a reasonable proposition, as the ability of money to fulfil any functional role is determined by its purchasing power, or its "real" value. In this, the first effect of the price level on the demand for money, the demand for money will tend to vary directly with the price level. Thus

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14. The "level of prices" is to be used in the sense of an index of the prices of all types of commodities, although this will not be possible at the empirical level.

the demand for money in nominal terms may vary while the demand for money in real terms remains constant.

The second effect of a price increase is to reduce the demand for money in real terms. This effect must be clearly distinguished from the first effect. It is not the level of prices itself, but the rate at which that level is increasing with which we are concerned here. The rate of increase of the price level is a measure of capital depreciation. Brown states that the rate of change of the price level "... is included as a measure of the expectations of appreciation or depreciation of money which may be supposed to exercise some influence on the propensity to hoard it."<sup>15</sup> Alternatively, looking at the rate of change of prices as a yield on physical goods, Friedman comments that "In addition, like equities, physical goods must be regarded as yielding a nominal return in the form of appreciation or depreciation in money value."<sup>16</sup> Thus the rate of change of prices is effectively a rate of interest, as it measures the cost of holding assets whose value is fixed in terms of money, relative to physical commodities. For example, if the

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15. Brown, A.J. Interest, Prices and the Demand Schedule for Idle Money (in Oxford Studies in the Price Mechanism, T. Wilson and P.W.S. Andrews (eds.) 1951, 31-50) p. 34.
  16. Friedman, M. The Quantity Theory of Money - A Restatement (in Studies in the Quantity Theory of Money, M. Friedman (ed.) 1956, 3-21) p. 7.

rate of increase of the price level is four per cent per annum, assuming that the carrying cost of physical commodities or assets whose value is based upon physical commodities is zero, the cost of holding money relative to physical goods is four per cent per annum. Thus four per cent per annum is the effective rate of return on physical commodities relative to money.

As in the case of interest rates, the significant factor is expectations about the rate of change of the price level. Current or past rates of change of prices are not important in themselves, as the gains or losses associated with such changes cannot be altered, having been already experienced, by any action taken in relation to money holdings and holdings of physical goods or assets whose value is fixed in real terms. In other words, instead of representing a specific quantity of money, assets whose value is fixed in real terms represent a specific quantity of physical goods.

The role of current and past changes in the price level is in determining expectations about the rate of change of the price level. The higher is the expected rate of increase in the price level, the greater will be the anticipated depreciation in real terms of money holdings and holdings of assets whose value is fixed in terms of money. There is, therefore, a strong motive for shifting out of money and other asset forms which suffer depreciation in real terms as a result of a positive rate of

change of the price level, when prices are expected to rise. Thus, as with the rate of interest and the demand for idle balances, so expectations about the rate of change of the price level and the demand for idle balances should be inversely related. In so far as actual price changes are indicative of expectations about future prices, observed rates of change of the price level will also be inversely related to the demand for idle balances.

The net effect of the price level upon the demand for money is indefinite. The first effect mentioned above -- that the demand for money is based upon the purchasing power of money -- leads to an increase in the demand for active balances of about the same order as the increase in prices. The second effect will lead, as seen, to an inverse relationship between the demand for idle balances and price changes. Whether the overall relationship between prices and the demand for money is an inverse one or a positive one depends upon the relative importance of the two factors. How sensitive the demand for money is to the rate of change of the price level is a matter of fact. It may be that small rates of change of the price level are sufficient to influence demand, or alternatively, it may be that fairly large changes are required. Friedman maintains that "... it takes substantial actual rates of price change to produce firm enough and uniform enough expectations

about price behaviour for this variable to play a crucial role."<sup>17</sup> Certainly in a state of rapid price changes the effect upon the demand for money will be considerable, as for example during periods of rapid inflation the depreciation of money holdings will be taking place so quickly that money holdings will be kept to an absolute minimum. However, this is a special case to be discussed more fully shortly. Apart from this extreme case the practical significance of the rate of change of the price level is questionable, at least when the rate of change of prices is around the three per cent per annum figure. Rates of change of the price level observable for Australia over the past fifty years reveal very few periods where the rate of change of the price level is above three per cent per annum. Thus under most circumstances the rate of change of the price level may not be very significant, although under certain conditions it may be overwhelmingly important. Also, while considering the net effect of price changes upon the demand for money, it must be remembered that only variations in the rate of change of prices will lead to adjustments in idle balances, whereas as long as prices are changing, adjustments will be required in active balances. For instance, if prices are increasing at an annual rate of three per cent over a long period the necessary adjustment to idle balances will have been made

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17. The Quantity Theory of Money - A Restatement. p. 20.



at some stage, and thereafter idle balances will not change, cet. par., until the rate of change of prices alters. However, under these same circumstances the money requirements for active balances will be increasing by three per cent annually. Therefore when the rate of change of prices is fairly constant the relationship between changes in the price level and the demand for money will be a positive one.

(ii) Price levels and full employment

If the demand for money is reduced in a situation of full employment, as a result of a rise in prices, so that the supply of money is in excess of the demand, the attempt by money holders to reduce their idle balances by buying assets will lead to a pressure of demand for assets, the supply of which cannot be expanded in the short-run. The effect of the increase in demand is thus going to be to increase the prices of assets. In other words, interest rates will fall and this will lead to an increase in planned investment. Attempts to implement new investment plans, because the supply of goods and services is inelastic, will therefore cause prices to increase. The increase in commodity prices generated will result in a further reduction in the quantity of money demanded, leading to a further increase in prices. In a state of full employment, the creation of an excess supply of money relative to demand will therefore result in successive price increases in the manner described.

The process may remain stable either because of a low elasticity of the demand for money with respect to price increases, or if investment plans are sufficiently insensitive to changes in interest rates. The whole process will be slowed if there are time lags in the adjustment of prices of goods and services to changes in the demand for them, and in the adjustment of the demand for money to changes in the explanatory variables. If the demand for money is highly elastic to price changes, and the rate of investment is highly elastic to interest rate changes, and if the time lags referred to are small, the system will be subject to rapid increases in the price level if the supply of money is in excess of demand in a state of full employment. With sufficiently high elasticities and with small time lags, the price level will increase indefinitely. At some rate of change of the price level people will lose all confidence in money, under which circumstance not only will money be regarded as being incapable of fulfilling its usual role of a "store of value" so that people will attempt to eliminate all idle balances, but also it will lose its function as a medium of exchange and a standard of measurement. However, such a situation of monetary crisis provides a field for study on its own,<sup>18</sup> and it should suffice for

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18. Cagan examines extensively the nature of rapid price inflation with particular reference to periods of monetary crisis actually experienced in a number of countries. In particular Cagan discusses the stability conditions of hyperinflation on pp. 64-77. See Cagan, E. The Monetary Dynamics of Hyperinflation (in Studies in the Quantity Theory of Money, M. Friedman (ed.) 1956) 25-117.

the moment to mention it as an example of the critical circumstances which may result from the relationship between the demand for money and the rate of change of the price level when the elasticity of production of goods and services approximates to zero.

#### IV. Tastes

The final variable to be considered in this analysis in relation to the demand for money is the tastes of individuals. The tastes of any individual are largely determined by environment, habits, customs and other similar factors, all of which are predominantly very stable and subject to slow change only. Consequently the tastes of an individual tend to change slowly, and so except in the long-run, the tastes of the individual may justifiably be regarded as constant. Apart from the gradual changes occurring in the tastes of individuals separately, the influence of tastes in the aggregate may be affected also by structural changes. People whose tastes lead them to hold large quantities of money in relation to income, assets or any other of the explanatory variables may, for some reason become relatively more important than the individuals with a lower liquidity preference. If this occurred the net result would be an upward shift in the demand schedule for money. However, any significant change in the distribution of income and assets in particular between groups of individuals with a high liquidity preference, and groups with a low liquidity preference could only be significant

in the long-run, unless we are contemplating conditions of social revolution. Therefore, the influence of tastes upon the demand for money will be, almost without exception, significant only in the long-run. Any shifts in the demand schedule for money will be very gradual and of little significance in contrast to the effects of the other variables relating to the demand for money. Thus the unavoidable omission of this variable from an analysis of the demand for money should not greatly weaken the analysis.

#### V. The modified demand-for-money function

To date the analysis has revealed a number of variables which may be closely related to the demand for money. To conclude this chapter, the variables and their relationship with the demand for money will be briefly examined and then the results of a change in the supply of money acting upon the explanatory variables will be examined, first in conditions of full employment and second in conditions of less than full employment.

##### (1) The nature of the extended Keynesian function

The important variables and their postulated relationships with the quantity of money demanded are:

(1) The level of money income, and the money value of total asset holdings are both positively related to the quantity of money demanded.

(2) The rate of interest, the rate of change of the

price level and the volume of highly liquid assets are inversely related to the quantity of money demanded.

These relationships yield a function of the demand for money:

$$M = L(Y, r, A, A_L, P', T)$$

where:

M is the quantity of money demanded

Y is the level of money income

r is the rate of interest

A is the money value of total assets

$A_L$  is the volume of highly liquid assets

$P'$  is the rate of change of the price level

T is included to cater for the variable tastes and any other non-measurable variables which have been omitted

The relationship between M and the explanatory variables can probably be represented linearly without deviating greatly from the real nature of the relationship. Then, ignoring the variable T, the demand schedule for money is given by:

$$M = a + bY + cA - dr - eA_L - fP'$$

This schedule will be the basis of the descriptions of the likely effect of changes in the supply of money relative to demand.

(11) The demand for money in full employment

This case has already been discussed in relation to price changes.<sup>19</sup> It was seen there that any event - whether an increase in the supply of money, or a shift in the demand schedule resulting from changes in variables not included in the function, or changes in the variables included - leading to a position where supply is in excess of demand, would have the same repercussions. If for instance the volume of liquid assets is increased, the quantity of money demanded falls, thereby resulting in an excess supply of money. If the supply of money remains unaltered, the attempts by holders of money to restore the equality of demand and supply gives rise to a number of possibilities. Ignoring possible shifts in the demand schedule the attempts by money holders to reduce their holdings will be reflected in some or all of the explanatory variables. For instance, the prices of assets may be bid up, so increasing the demand for money by increasing the money value of total assets, and by reducing the rate of interest. If the increase here is sufficient to restore the equality of supply and demand and there are no secondary effects, then money income and commodity prices will remain unchanged. However, secondary effects influencing commodity prices are highly probable. If expenditure is sensitive to interest rate changes, the fall in the rate of interest will

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19. pp. 81-83.

induce a rise in the demand for goods and services. When all resources are fully employed, the elasticity of output is zero. Under these circumstances an increase in the demand for goods and services will lead to an increase in their prices, unless stocks of goods are sufficiently large to absorb the increase.

Money income will therefore rise and further increase the demand for money, thereby tending to restore the equality of the demand for and supply of money. However, the increase in the commodity price level will have another effect. If it results in an increase in the rate of change of commodity prices, the demand for money will be reduced. If the effect of the increase in the rate of change of prices upon the demand for idle balances more than offsets the effect of the increase in the price level operating through money income upon the demand for active balances, the increase in the price level is a factor disturbing the equality of the demand for and supply of money. The disturbance in the equality as a result of the increase in the general price level will be corrected in the same manner as just outlined, ending in another increase in the price level. Thus in a state of full employment, the rate of change of commodity prices is a factor disturbing the equality of the demand for and supply of money, as once an increase in the level of prices has occurred it may be followed by successive price increases, without any other changes in supply or demand conditions.

Whether the successive price increases dwindle or increase in size depends upon a number of factors. Other things being equal, the system will be more stable:

1. The higher is the elasticity of the demand for money with respect to changes in the money value of total asset holdings and changes in the rate of interest.

2. The lower is the elasticity of the demand for goods and services with respect to interest rate changes.

3. The lower is the income velocity of circulation of active balances, since the lower is this velocity, the more money will be required for active balances for any given change in the price level, and hence in money income, and therefore the more this effect of price increases will offset the effects of increases in the rate of change of prices upon the demand for money.

Whether the system is stable or unstable, the whole process will be considerably retarded if there are time lags. There may well be a time lag in the adjustment of the demand for money to changes in any of the explanatory variables. For instance, if the price level rises it may require some period before the individual comes to reassess his money holdings in the light of that price change and the manner in which it influences his expectations. There may also be a time lag in the adjustment of the prices of goods and services to changes in



the demand for them, either due to the holding of considerable stocks of goods, or due to market imperfections.

The effect of a rise in the supply of money relative to the demand in a state of full employment will tend to lead to a process of rising prices which may or may not be stable. The opposite case yields similar results. If the supply of money is less than the demand for it, the attempt by individuals to expand their money holdings will lead to results which are the reverse applying in the preceding case. The money value of total assets will fall, income will fall and the level of prices will fall. Once again the stability of the process will depend upon the relevant elasticities and the pace at which the process takes place will vary with time lags in the responses of the factors concerned.

(iii) The demand for money in a state of less than full employment

If in a state where unemployment exists on a significant scale, the supply of money increases relative to demand, the nature of the adjustments in the explanatory variables will be the same as in the full employment example, except that instead of prices rising or tending to rise, in the short-run stocks of goods will be run down and in the long-run output will increase. Not only will prices not tend to obstruct a return to equilibrium, but in a state of less than full employment equilibrium is much

less likely to be disturbed by autonomous price increases as conditions are less favourable for price increases. Thus in a state of under-full employment, an increase in the supply of money, assuming that the volume of liquid assets is constant, will have the effect of increasing output and employment by means of lower interest rates and greater demand for goods and services, with probably little effect on general price levels.

If the supply of money falls relative to the demand, people will try to increase their money holdings and asset prices will fall until downward changes in the money value of asset holdings and upward changes in the rate of interest bring the demand for and supply of money into equality once again. The demand for goods and services will be reduced through the incentive effect, and in the short-run, stocks of goods will increase, and in the long-run output will fall. In this case there will be a tendency for prices to fall in which circumstance the demand for money will be further increased - people may buy less goods and services, deferring expenditure in anticipation of further price falls. Thus in an under-full employment situation, an initial fall in the price level may tend to perpetuate itself through the demand for money. Where the process of successive price reductions will stop, and the speed at which it will take place, will depend upon the elasticities and time lags mentioned in the full employment case, and the

rapidity with which output and employment levels adjust to new levels of demand for goods and services. The more rapid the adjustment, and the more elastic is the demand for money to price level changes, the more rapid will be changes in the price level, and the further levels of output and employment may fall before reaching equilibrium at some lower level.

## CHAPTER FOUR

### AN EXAMINATION OF EMPIRICAL ANALYSES OF THE DEMAND FOR MONEY

All the analyses considered in this chapter are concerned with the estimation of a demand-for-money function. However the functions examined vary considerably in structure, and in particular the dependent variables differ. For instance, some functions have as the dependent variable an interest rate while others use income velocity. Some analyses use idle balances as a variable in the function rather than total money holdings. Therefore it will be useful, before proceeding to look at the different studies in the field of the demand for money to examine the different methods used to estimate idle balances.

#### A. The Estimation of Idle Balances

The division of balances into that part which is active and that part which is idle, with the level of active balances being determined by the need to effect transactions, involves the notion of an institutional velocity. Institutional velocity is regarded as that velocity which is attainable - the maximum volume of transactions in terms of money which can be supported by a given quantity of money over a specified period. The magnitude of this velocity is determined by the nature of the relevant institutions of the society concerned. If an innovation by some means

increases the "efficiency" of money, by enabling a specified quantity of money to handle a larger volume of transactions in any given period, then the institutional velocity of money is increased. Because institutional change takes place slowly, it seems likely that the institutional velocity of a particular society would be reasonably constant, particularly over a short period. It is often regarded as convenient to separate out that part of money holdings required for transactions to enable a separate analysis of the factors influencing and influenced by the remainder of total money holdings. The only divergence on this issue between many of the different studies examined is in the methods used to estimate the relationship between active balances and total transactions, and thereby to obtain estimates of idle balances.

Two basic methods are used, though often with considerable modifications. We shall refer to these as the method of maximum sample velocity and the regression method. These two methods, with their more important modifications, will be considered in turn.

#### I. The Method of Maximum Sample Velocity

This method either relates income to the total volume of bank accounts, both deposit and current, or alternatively it relates total current account debits (or total bank clearings) to total balances on current account. Generally the notion of income velocity is favoured, income being regarded as a fair approximation to total transactions. Total debits to current

accounts, or alternatively, bank clearings, is used in some cases, as it is perhaps more closely allied with total transactions than is income. Income has the advantage, however, that reliable figures are usually more easily obtained over a considerably longer period than is the case with total debits to current accounts. Also, when current accounts alone are used, many active balances held in deposit accounts would be ignored. The implication of using current accounts alone - that current accounts are predominantly active, and deposit accounts are predominantly idle - is a dubious one.

Whichever of the two sets of variables is chosen, the technique used in the method of maximum sample velocity is the same. The method may be illustrated in terms of the second of the two alternative combinations of variables above. From time series figures for total debits to current accounts and for current account balances, the ratio of total debits to current accounts is computed for each year of the time series. The greatest of these ratios is assumed to represent the institutional velocity of the particular society being considered. It is, therefore, implied that all balances held on current account in the year of maximum sample velocity are required for the transactions of that year, so that idle balances on current account are zero. The estimated institutional velocity is then used to obtain estimates of idle balances for all years in the sample.

The velocity estimate is the velocity of circulation of active balances. Using this velocity we can obtain an estimate of active balances if we know the figure for total debits to current accounts. Thus estimates of active balances can be obtained for all years of the time series. If we have a time series on the volume of money an estimated series for idle balances is obtained by subtracting the figure for active balances from that for the volume of money for each year. If the other set of variables, income and the total of bank deposits, is used, total debits is replaced by income and deposit accounts as well as current accounts are included in calculating the maximum sample velocity. In the year of maximum sample velocity, there are assumed to be no idle balances held either on deposit or current account. In this year the ratio of income to total money holdings is assumed to be the income-velocity of circulation of active balances. Symbolically

$$\frac{Y_m}{M_m} = V_m \quad \dots \quad \dots \quad (1)$$

and

$$M_m = M_{1m} \quad \dots \quad \dots \quad (2)$$

where

$Y_m$  is the level of income in the year of maximum sample velocity

$M_m$  is total money holdings in the same year

$V_m$  is the maximum sample velocity

$M_{1m}$  is active balances in the year m.

Using  $V_m$  as an estimate of the income velocity of circulation of active balances, the general relationship for estimating active balances for each year is:

$$\frac{Y_t}{V_m} = M_{1t} \quad \dots \quad (3)$$

where

$Y_t$  is the level of income in the year t

$M_{1t}$  is active balances in the year t.

Therefore, a time series for active balances may be obtained. Then idle balances can also be derived for the same years from the relationship:

$$M_{2t} = M_t - M_{1t} \quad \dots \quad (4)$$

where

$M_{2t}$  is idle balances in the year t

$M_t$  is the volume of money in the year t.

It must be emphasised that the crucial assumption in the method of maximum sample velocity is that in the year of the time series selected when the particular velocity being considered is greatest, all money holdings in the case of income velocity, and all current accounts in the case of transactions velocity, are assumed to be active.



## II. Regression Estimates

### (i) The standard procedure

The second basic method for deriving idle balances is by means of regression estimates. The demand function for money is assumed to take a particular form, and this is fitted statistically over the period being studied. Either estimates of total transactions or income are included as a variable in the function. A velocity estimate can then be obtained from the regression, and using this velocity, active balances may be estimated. An estimate of idle balances can be obtained from the volume of money series by subtraction.

One author who uses this method is Khusró.<sup>1</sup> He postulates the following relationships:

$$M = M_1 + M_2 \quad \dots \quad \dots \quad \dots \quad (5)$$

$$M_1 = k_1 Y \quad \dots \quad \dots \quad \dots \quad (6)$$

$$r_n = a - b \frac{M_2}{A} \quad \dots \quad \dots \quad \dots \quad (7)$$

where

$M$  is the total quantity of money demanded

$M_1$  is the demand for active balances

$M_2$  is the demand for idle balances

$Y$  is national income

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1. Khusró, A.M. An Investigation of Liquidity Preference (in York. B. Vol. 4, No. 1: 1-20, 1952).

$r_n$  is the rate of interest

$A$  is a selection of assets taken to represent the total assets of the community.

It is interesting to note that the rate of interest is the dependent variable in the function incorporating idle balances.

Substituting (1) and (2) in (3) we get

$$\begin{aligned} r_n &= a - b \frac{(M - M_1)}{A} \\ &= a - b \frac{(M - k_1 Y)}{A} \\ r_n &= a - b \frac{M}{A} + b k_1 \frac{Y}{A} \dots \dots (8) \end{aligned}$$

This relationship is fitted (the method of estimation is not mentioned) and an estimate of  $k_1$  is obtained by dividing the first coefficient into the second.  $k_1$  is the Cambridge  $k$  and an estimate of the income velocity of money can be obtained by taking the reciprocal of the estimate of  $k_1$ . Using the series of income figures over the period being examined, and the estimated income velocity of money, Khusró is able to obtain the transactions demand for money for the series of years. Then the demand for idle balances in each year is total money holdings less the demand for active balances derived in this way.

#### (ii) A modified approach

A variation on the regression estimate technique

is that used by A.J. Brown.<sup>2</sup> In this analysis, total debits to current accounts is used instead of income and total money holdings, and is divided into two groups which are referred to as financial and business turnover. Financial turnover is defined as total debits to the accounts of financial enterprises and is taken to be represented by town bank clearings. Non-financial, or business turnover, is defined as total debits to the accounts of business enterprises and Brown assumes metropolitan, country and provincial bank clearings to be a reasonable approximation of this. Both series on bank clearings are adjusted for intra-bank transactions. The total deposits used in the analysis is the total volume of deposits of all kinds in the London clearing banks. Those money holdings which are excluded are presumed to vary in more or less the same way as deposits with the London clearing banks. Brown then fits the function (the method of estimation is not stated)

$$D = a + bB + cF - dr + cP^1 \quad \dots \quad (9)$$

where

D is total deposits as already defined

B is annual business turnover

F is annual financial turnover

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2. Brown, A.J. Interest, Prices, and the Demand Schedule for Idle Money (in Oxford Studies in the Price Mechanism, T. Wilson and P.W.S. Andrews (eds.) 1951, 31-50).

$r$  is the rate of interest

$P'$  is the rate of change of the price level.

The demand for active balances is given by  $bB + cF$ , and the demand for idle balances by  $a - dr + cP'$ . The demand for active balances may be subdivided into financial demand and business demand. The former is given by  $cF$  and the latter by  $bB$ . Thus we have:

$$D_F = cF \quad \dots \quad \dots \quad \dots \quad (10)$$

$$D_B = bB \quad \dots \quad \dots \quad \dots \quad (11)$$

where

$D_F$  denotes financial demand

$D_B$  denotes business demand.

From the first relationship we get:

$$\frac{F}{D_F} = \frac{1}{c}$$

and from the second we get

$$\frac{B}{D_B} = \frac{1}{b}$$

Thus the reciprocal of the coefficient  $c$  is an estimate of financial velocity and the reciprocal of  $b$  is an estimate of business velocity. If we are given a series of figures for financial and business turnover (debits to financial and business deposits) we can use the estimated velocities to obtain a series for active balances. The figures can be subtracted from the corresponding figures for total deposits to obtain idle balances

for each year. Alternatively idle balances may be estimated directly by the relevant part of the demand-for-money function,  $a - dr + cP'$ , provided that information about the rate of interest and the rate of change of prices is available for the period concerned.

In some analyses, basically the same method as that used by Khusrro or Brown is used, but is not fully carried through. A regression including money and income, or debits to current accounts, as two of the variables is fitted as in Khusrro's analysis. However, no attempt is made to obtain two separate functions, one explaining the demand for active balances and the other the demand for idle balances, so that the explained variable remains the total demand for money. There is no explicit recognition of the ability to derive separate estimates of the demand for active and idle balances. The individuals who adopt this approach must regard the division of the function on some arbitrary basis into two separate entities as either not particularly significant or perhaps not justifiable.

### III. Limitations of the Two Methods

#### (i) The maximum sample velocity method

The maximum sample velocity method assumes that in the year when the income or transactions velocity is the highest there are no idle balances. This assumption is convenient but obviously subject to error. There is a strong possibility that the maximum sample velocity method will lead to an understatement

of idle balances. This can be seen by the following argument. If we consider income velocity, it is not likely that, particularly over the relatively short periods examined, the level of income will in any one year be large enough relative to the quantity of money for all of it to be required to effect transactions. In fact it would call for extremely unusual circumstances for such a position to arise. Even in circumstances when the quantity of money is small, the level of money income large and conditions generally such that the holding of idle balances is not desirable, it is probable that some people will still hold some idle balances. The series for active balances estimated using this maximum sample velocity will be in error to the extent that idle balances are held in the year when the ratio of income to the quantity of money is greatest.

It seems likely that a greater proportion of current accounts will be active than will be the case for the total of savings deposits and cash. Therefore, in the year when the sample velocity is greatest, it is also likely that a greater proportion of current accounts will be active than for the volume of money (current accounts, and savings deposits plus cash). If this proposition is correct then the estimation of the institutional velocity of circulation of money will be subject to greater error when the volume of money is used rather than when only current accounts are used. For example, we may assume that the proportion of active balances held in current accounts is twice that held in savings accounts plus cash. Then, in the

year when the ratios of total current account debits to current accounts and income to total deposits are greatest, the proportion of active balances held on current account may be ninety percent. The corresponding proportion for savings deposits plus cash will, on our assumption, be forty-five per cent, and therefore the proportion of the volume of money which consists of active balances, if we assume that the volume of money is comprised of equal portions of current accounts and savings accounts plus cash, will be sixty-seven and one-half per cent. Therefore the size of active balances will be exaggerated more in the case of the volume of money than in the case of current accounts, and consequently the velocity will be understated to a greater extent in the former case. In the year when the sample velocity is at a maximum, on the assumptions made, the velocity estimate will only include the same proportion of active balances using either the volume of money or current accounts if the proportion of active balances held in each is one hundred per cent.

It is possible that the reverse is the case in that the volume of money may consist of a greater proportion of active balances than does current accounts. However, although cash holdings are likely to be at least equally as active as current accounts, it seems unlikely that as high a proportion of savings accounts will be active as in the case of current accounts. The transactions velocity (relating total current account debits to current accounts) also has the advantage that it includes solely

monetary transactions and also includes money transactions which are not included in national income, but which still require the holding of active balances. However, to offset this there is the disadvantage with the transactions approach that only debits to current accounts are recognised, and if all current accounts are active in the year of maximum sample velocity, active balances which are held either in cash or savings accounts will not be included in the estimates of active balances and will therefore appear in idle balances. Therefore, it appears that on the one hand the maximum sample velocity method of estimating idle balances is likely to be subject to a smaller error, by virtue of the assumption of zero idle balances in the year of maximum sample velocity, when using current accounts than when using the volume of money. However, on the other hand, the method will be subject to greater error when using current accounts due to the exclusion of active balances held in savings accounts and in the form of cash.

#### (11) The regression method

The regression estimates are obtained by assuming that the quantity of money is related to particular variables in some manner which is specified in whatever function is used. Once again there is a considerable likelihood of error as it is probable that in most cases some variables are omitted which should be included, and the form of the function adopted may not be the most appropriate. The accuracy of the regression method will thus depend upon the soundness of the method used to choose



the variables and the form of the function.

Since either of the two methods of estimating idle balances may be used, which one is to be preferred? Brown uses both the methods outlined and the series for idle balances which he obtains show similar patterns and differences only in scale. For instance the estimates of idle balances using the regression method are in all years about two thirds to three quarters the size of the corresponding estimates obtained by applying the maximum sample method to current accounts. Brown concludes that "In the event, it does not seem to matter very much which reasonable method is used for estimating total idle money."<sup>3</sup> Brown was, therefore, led to the conclusion that no real change will result in the basic pattern of the function obtained whatever "reasonable" method is used for the estimation of idle balances. However, Khusrro reaches a different conclusion. He finds that the coefficient of correlation for the relationship between idle balances and the yield on 2½% Consols is considerably higher when using regression estimates of idle balances than when using idle balances estimated by the maximum sample velocity method. Therefore Khusrro concludes that the regression method is the superior method of the two for estimating idle balances.

It is difficult to answer the question of which method is to be preferred. The evidence relating to the methods of

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3. Brown, A.J. Interest, Prices, and the Demand Schedule for Idle Money. p. 35.

estimating idle balances is conflicting. Both involve arbitrary assumptions regarding the nature of active balances which lead to errors in the resulting estimates, and it is not possible to discern which method minimises such errors. Neither of the two basic methods used for estimating idle balances appears significantly better in any way than the other, although Khusró's results indicate a preference for the regression method. Perhaps the only ground for making a choice, and that in favour of the regression method, is that the maximum sample velocity method is essentially a crude one.

#### B. Empirical Analyses of the Demand for Money

The various surveys of the demand for money fall into several categories. The majority are aggregate analyses, involving the whole economy. Other analyses are not comprehensive, dealing with a particular sector or group of sectors only. These two categories will be examined in turn with further sub-classification according to the explanatory variables used in the function of the demand for money. Within each sub-classification there will be further differences. For instance, some analyses use the rate of interest as the dependant variable, while others use the income velocity of circulation of total money holdings or transactions velocity, or the reciprocal of these. Further differences occur in the variables included. Some examinations use a short-term rate of interest, while others use a long-term rate, and differences occur in the definitions of other variables

such as the volume of money. These differences will be mentioned specifically.

In the analyses to be considered, some writers express conclusions in terms of the income velocity of circulation of total money holdings. For the sake of clarity and to enable the comparison of the results of different analyses, these conclusions are at times restated in terms of desired idle balances. Also when considering the nature of the relationship between income velocity and interest rates for example, the usual approach is to postulate an inverse relationship between the demand for money and interest rates and to reverse the direction when determining the relationship between income velocity and interest rates, so that income velocity and interest rates will be directly related. However, writers using the velocity approach have neglected to investigate closely the implications of changes in desired income velocity for changes in desired idle balances. It will facilitate later discussion if this problem is considered here.

If we examine an increase in income velocity there are a number of possibilities:

1. There may be a fall in the quantity of money with no change in income.
2. There may be a rise in the level of income with no change in the quantity of money.
3. The level of income may rise together with a fall in the quantity of money.

4. Both the level of income and the quantity of money may rise, but with the latter increasing by a smaller proportion.

5. Both income and the quantity of money may fall, with the fall in the quantity of money being proportionately greater than the fall in income.

For the first three possibilities idle balances will be smaller, since in the case of 2. and 3. the active balances required will increase and there is no corresponding increase in the quantity of money, while in the first case the active balances required will not change and therefore the fall in the quantity of money will result in smaller idle balances. The movement of idle balances in the last two cases is not as easily seen. For 4. desired active balances will increase, and therefore the condition required if idle balances are to decrease is that the quantity of money increases by less than active balances. Symbolically:

$$\frac{\Delta Y}{V_a} < \Delta M$$

where

$V_a$  is the income velocity of circulation of active balances  
and is a constant for all income levels

$\Delta Y$  is the change in the level of income

$\Delta M$  is the change in the quantity of money.

Thus  $\Delta Y/V_a$  gives us the change in active balances required to satisfy the transactions demand for money arising from the change in the level of income. The condition may be restated as:

$$\frac{1}{V_a} > \frac{\Delta M}{\Delta Y}$$

or as  $V_a \leq \frac{\Delta Y}{\Delta M}$

or as  $\Delta Y \geq V_a \Delta M$

This condition is unlikely to be satisfied. For instance if  $V_a = 5$ , then the condition requires that the increase in the level of income be more than five times the increase in the quantity of money. The velocity of circulation of active balances of five chosen in this example is a conservative example in the light of estimates made in the analyses which will be examined later. Even in this example the increase required in the quantity of money is less than one-fifth of the increase in income if idle balances are to decrease. This condition is unlikely to be satisfied since the income velocity of circulation of total money holdings ( $\frac{Y}{M}$ ) in the countries which are treated in the analyses to be examined is generally much smaller than five, and therefore it is unlikely that changes in this velocity ( $\frac{\Delta Y}{\Delta M}$ ) could be consistently as large as five. Therefore, it is not likely that an increase in the income velocity of circulation of money, which results from an increase in both income and the quantity of money, will be accompanied by a decrease in idle balances - that is, the increase in the quantity of money is likely to be more than sufficient to meet the increased demand for active balances.

In the case of the fifth possibility we have a fall in

the quantity of money proportionately greater than the associated fall in the level of income. In this case the condition required for idle balances to decrease is that desired active balances decrease by less numerically than the decrease in the quantity of money. Thus the condition is:

$$\frac{\Delta Y}{V_a} < \Delta M$$

which may be expressed as

$$V_a > \frac{\Delta Y}{\Delta M}$$

or as

$$\Delta Y < V_a \Delta M$$

where  $\Delta Y$  and  $\Delta M$  are the numerical decreases in the level of income and the quantity of money respectively. This condition is the reverse of that considered under the fourth possibility. In terms of the example used in connection with the fourth possibility, a decrease in idle balances will occur when the decrease in the quantity of money is more than one-fifth of the decrease in the level of income. Thus a decrease in idle balances is likely to occur under these circumstances. In the example used, the quantity of money needs only to fall by more than one-fifth of the fall in income and idle balances will decrease, and a fall in the quantity of money of that order relative to the fall in income seems highly likely.

In the first three situations considered which will result in an increase in the income velocity of total money holdings, idle balances will always fall. In the fifth situation considered,

idle balances will under most circumstances decrease. The only real exception to this conclusion is in the fourth case when both income and the quantity of money increase. In this case it is highly likely that an increase in income velocity will be accompanied by an increase in idle balances. Therefore, as a general statement we can say that it is likely that an increase in the income velocity of total money holdings will be accompanied by a decrease in idle balances.

Similarly, when the ratio being examined is that of the volume of money to the level of income, the conclusions will be the reverse. Increases in the ratio will generally be accompanied by an increase in idle balances. However, there is a quite conceivable set of circumstances as outlined which takes exception to this general statement.

## I. Aggregate Analyses

### (1) Simple functions

Under this sub-section fall surveys which use a demand-for-money function of approximately the same form as that used by Keynes, where the demand for money is a function of the level of income and the rate of interest. There are four analyses to be examined here, all of them fairly short and relatively elementary. Tobin<sup>4</sup> does not actually set up a demand-for-money function, but

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4. Tobin, J. Liquidity Preference and Monetary Policy (in Rev. Econ. Stats. Vol. 29, No. 2: 124-131, 1947).

he is concerned with desired idle balances as the variable to be explained, or the dependent variable. Rousseas<sup>5</sup> concentrates attention upon the income velocity of circulation of money as the dependent variable. Latané's<sup>6</sup> analysis centres upon a logarithmic function which has the Cambridge  $k$  as the dependent variable. As in the case of Tobin's analysis, Ritter<sup>7</sup> does not fit a function. He examines the relationship between the Cambridge  $k$  and the rate of interest with the emphasis on the former as the variable to be explained. He then proceeds to look at idle balances as the dependent variable. In all cases, except for Latané's study, the function used incorporates some short-term rate of interest, and in this way differs from the Keynesian function which is concerned with the interest rate on bonds. Thus all these functions, although they contain basically the same variables as in the Keynesian demand-for-money function, are different to some extent in the specific nature of the variables used, and the form of the function used.

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5. Rousseas, S.W. Velocity Changes and the Effectiveness of Monetary Policy (in Rev. Econ. Stats. Vol. 42: 27-36, 1960).
  6. Latané, H.A. Income Velocity and Interest Rates: A Pragmatic Approach (in Rev. Econ. Stats. Vol. 42: 445-449, 1960).
  7. Ritter, L.S. Income Velocity and Anti-Inflationary Monetary Policy (in Am. Econ. Rev. Vol. 49, No. 1: 120-129, 1959).



Tobin sets out to establish that the demand for money has some degree of elasticity to changes in the rate of interest in the U.S. His study covers the period 1922-1945. Idle balances are estimated by the maximum sample velocity method<sup>8</sup> using current accounts and total debits. He then proceeds to examine the relationship between idle balances and the short-term interest rate. The actual rate used was an average commercial paper rate. There is no attempt made to fit a function statistically, so that the results derived from the analysis are in general terms only. When idle balances and the rate of interest were plotted together graphically, they revealed a hyperbolic relationship between the variables with an increasing interest-elasticity of the demand for money as interest rates fell.

Similar results were obtained whether using all banks or particular bank groups. Thus all that can be concluded from Tobin's analysis is that it provides results which are consistent with the general nature of the relationship between money and interest rates as presented by Keynes.

In a short study Rousseas examines the determinants of desired income velocity for the period 1951-1957 in the U.S. on a quarterly basis. Money is taken to be represented by balances on current accounts adjusted for interbank deposits, plus currency outside banks. For the rate of interest a simple average of the

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8. See pp. 93-96 above.

most sensitive indicators of market conditions is chosen: the federal funds rate, the dealer loan rate, and the Treasury bill rate. Gross national product is used to provide a series for income. An income velocity series is then obtained by dividing gross national product by the quantity of money, as defined, for each quarter. This velocity series is then plotted against the three-month Treasury bill rate, with the bill rate on the vertical axis. No numerical results are given, but two curves are drawn through the series of points, one for the period 1951-1953 and the other for the period 1955-1957. The method used to fit these curves is not mentioned. The curves indicate that the interest rate-velocity relationship is approximately a straight-line relationship, with velocity increasing as the rate of interest increases, possibly approaching an asymptote at  $V = 3.5$ . Thus idle balances will probably fall as interest rates rise.<sup>9</sup> These conclusions support the hypothesis of an inverse relationship between the demand for idle balances and interest rates, with a limit where changes in the rate of interest will have no effect on the demand for money - the demand for money tends to become inelastic to changes in the rate of interest at very high levels of that rate. However, there is no evidence to suggest an increasing elasticity of the demand for money at low rates of interest. The demand for money appears to lack sensitivity to

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9. See pp. 107-111 above for a discussion of the relationship between idle balances and the income velocity of total money holdings.

changes in the rate of interest, even at low rates. Using Rousseas' own example,<sup>10</sup> an increase of about fourteen per cent in income velocity was accompanied in the 1955-57 period by increases in short-term rates of interest of about one hundred and fifty per cent (for instance the bill rate increased from 1.5% to 3.4%). In the 1951-57 period velocity increased by five per cent, and interest rates increased by sixty per cent. From these and other examples which can be drawn from the tables, Rousseas concluded that the demand for money is not highly sensitive to changes in interest rates at low levels of these rates, since the small velocity changes would indicate that the demand for idle balances does not alter a great deal in response to large interest rate variations.

The analysis leads Rousseas to believe that the money requirements of an economy for transactions alter as institutional changes take place, and since shifts in the velocity function are apparent, in fact he concludes that money requirements are decreasing relative to income. One important institutional change which is taking place is the concentration of business in the hands of fewer people or organisations. The result of this concentration is to reduce the volume of inter-business transactions, so that for a given income level a smaller quantity of money will be required to effect transactions. Also the expansion

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10. Velocity Changes and the Effectiveness of Monetary Policy, p. 34.

of trade credit and the ability of large corporations to obtain funds either on the market or through the banking system, where smaller businesses would find it more difficult, reduces the cash balances required to be held relative to the level of transactions. These changes strengthen the argument that the concentration of business diminishes the effectiveness of monetary policy in bringing about a contraction of economic activity, so that to achieve some desired contraction in economic activity, greater increases in interest rates and reductions in the liquidity of the banking system will be required the greater is the degree of business concentration. Not only does the concentration of business reduce the effectiveness of monetary policy, but, because larger businesses are more "immune" to the influence of monetary policy, the application of restrictive monetary measures will tend to further enhance the position of large businesses relative to small ones. In this manner the use of monetary policy tends to hasten its own demise.

Thus we have a twofold weakness:

- (1) The field in which monetary policy is most successful is becoming smaller as a result of the concentration of business which process is hastened by the use of restrictive monetary measures.
- (2) This same field - that in which monetary policy is most successful - is becoming increasingly independent of monetary policy measures with the increasing development of non-bank financial institutions which convert idle balances into active

balances by borrowing from non-spenders and lending to spenders.

There may be a considerable degree of truth in both these suppositions, but the support provided for them from Rousseas' analysis is limited. The analysis is conducted over the fairly short period of seven years, from 1951 to 1957, and the support for his conclusions relies heavily upon two features which emerge. First, the demand for money appears to be inelastic with respect to changes in the rate of interest. Large movements in short-term rates of interest are associated with relatively small variations in the quantity of money given the level of income, even at low rates of interest. Second, there is some evidence in shifts in the function to support the hypothesis that institutional and other changes are reducing the effectiveness of monetary policy. The demand for money at a given level of income and given interest rate is decreasing over time. The evidence of interest-inelasticity of the demand for money, and shifts in the velocity function support the hypothesis that the effectiveness of monetary policy is diminishing. However, it must be remembered that the scope of Rousseas' empirical analysis is limited.

We turn now to Latané who is concerned with the desired Cambridge  $k$  for the U.S. over the period 1909-1958. There are four facets of the field of monetary economics which Latané considers deserve examination. These are:

(1) Secular trends in velocity. This is chiefly concerned with

institutional changes, as examined by Rousseas<sup>11</sup> and changes in the habits of individuals.

- (2) The interest-elasticity of the demand for idle balances.
- (3) The effectiveness of monetary policy - which is linked with (1) in the long-run and (2) in the short-run.
- (4) The problem of debt-management.

The three variables he considers are income, money and interest rates. In contrast to Tobin and Rousseas, Latané uses a long-term rate of interest which is consistent with the Keynesian function. The relationship fitted is:

$$\log \frac{M}{Y} = a + b \log r \quad \dots \quad (12)$$

where M is demand deposits plus currency outside banks

Y is gross national product

r is average long-term corporate bond yields.

The method used for fitting the relationship is not mentioned. The relationship fitted assumes a constant interest elasticity of the demand for money as a proportion of income. However, the scatter of observations about the fitted curve indicates that possibly a better fit could have been obtained. Latané concludes from the deviation of the observed points from the estimated curve that the desired Cambridge k, and therefore probably desired idle balances,<sup>12</sup> has a very high elasticity to changes in the rate of interest at low levels of this rate. However, he does not find evidence to support the view that the desired Cambridge k becomes highly inelastic to changes

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11. p. 115 above.

12. pp. 107-111 above.

in the rate of interest at high levels of the interest rate.

Latane finds nothing in his investigation to support Friedman's hypothesis that there has been a shift over time in the function of the Cambridge  $k$ ,<sup>13</sup> his figures for the whole period being consistent with a single function relating interest rates and income velocity. Also it may be noted that his conclusion that the demand for money becomes inelastic to the rate of interest at high levels of that rate is not supported by the evidence is in direct opposition to that of Rousseas.<sup>14</sup> It may be that the rates of interest required for the demand for money to become relatively inelastic to changes in the rate are higher than those observed by Latane, and therefore that the income velocities which will be sufficiently high to give rise to an interest-inelastic demand for money are outside the range of velocities normally encountered.

Turning now to Ritter, we find that he concentrates on an analysis of quarterly figures for the 1948-1957 period in the U.S. The average rate on Treasury bills is plotted against the ratio  $\frac{M}{Y}$ , where  $M$  is demand deposits, other than government or interbank deposits, plus currency outside banks, and  $Y$  is gross national product. The resulting chart shows a simultaneous rise of velocity and the bill rate over the period. No attempt is made to fit a curve to the plotted points, so only general inferences may be drawn from the analysis. The information is very similar to that used by Rousseas,<sup>15</sup> and the general results are the same. The grouping of the points plotted indicates that a shift in the income velocity

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13. pp. 161-167 below.

14. p. 115 above.

15. pp. 113-117 above.

function may have occurred between 1954 and 1955, as is the case in Rousseas' analysis. Also, as with Rousseas, Ritter suggests that the evidence points towards a velocity asymptote.

Then idle balances are estimated by the maximum sample velocity method. When the time series for idle balances and the bill rate are plotted, a series of points ranging downward to the right, in approximately a straight line results. However, again Ritter makes no attempt to derive regressions from the data, and therefore no information is obtained about elasticities or the shape of the function, so the direct inferences to be drawn from the work are limited. Generally all that can be said is that the results obtained provide support for the thesis that interest rates and the demand for idle balances are related inversely. Also the plotted points indicate that the interest-elasticity of the demand for idle balances may be higher for low levels of the rate of interest. Thus a reduction in the quantity of money may have a much smaller effect upon the rate of interest when the rate of interest is low compared with when it is high.

An interesting feature in Ritter's analysis is in the two charts plotting the Treasury bill rate against the income velocity and idle balances. The two charts reveal opposite movements. The higher is the quarterly figure for income velocity the lower is the corresponding figure for idle balances in the majority of cases. This supports the general conclusion reached earlier that income velocity and idle balances will tend to move in opposite directions.<sup>16</sup>

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16. This confirms the conclusion drawn on p. 111 above that desired velocity and desired idle balances will tend to move inversely.



Another analysis to be dealt with in this section and one which will be returned to again in this chapter, is that by Bronfenbrenner and Mayer.<sup>17</sup> Only the examination of short-run functions will be dealt with at this stage. The analysis extends into more complex functions which will be examined under later sections.<sup>18</sup> Their analysis covers a long time (1914-1957), which is broken up into shorter time periods in order to examine a series of short-run functions. The purpose of this approach is to obtain a better idea of what the relationship between interest rates, income and the demand for money is like. It is presumed that this relationship will be less subject to the effects of changes in other variables over short time periods. The hypothesis is then that over many short periods changes in variables influencing the demand for money, other than income and interest rates, will be relatively small. If we accept this notion the relationship between money, interest rates and income can be isolated more completely over a short period of time than over a long period. Of course much of the usefulness of short-run functions will depend upon the ability to select those periods in which changes in the other variables are relatively small. A compensating disadvantage lies in the possibility that not only will changes in variables excluded from the function be small, but that changes in those variables included in the function will also be

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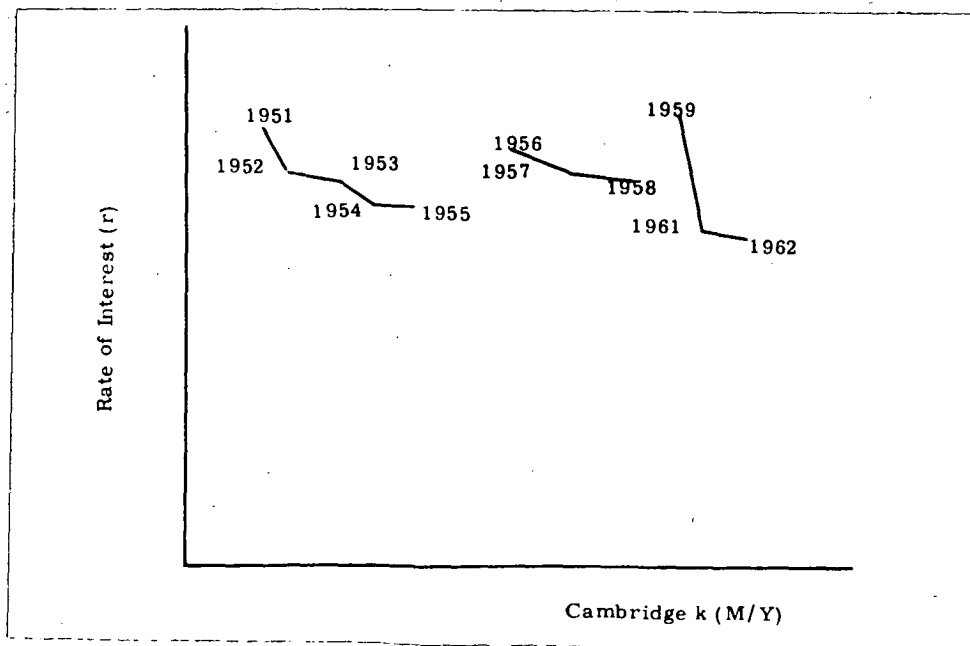
17. Bronfenbrenner, M. and T. Mayer. Liquidity Functions in the American Economy (in Econometrica. Vol. 28: 810-834, 1960).

18. pp. 145-150, 169-172 below.

comparatively small, and that perhaps the range of observations for any particular period may not be sufficiently wide to yield a useful function of the demand for money.

Bronfenbrenner and Mayer plotted a series of points relating the short-term interest rate, on the vertical axis, to the Cambridge  $k$  on the horizontal axis. For the period before World War II the four-to-six months commercial paper rate is used. The period of the War is excluded from the analysis and for the period after the War the Treasury bill rate is used. The Cambridge  $k$  is the ratio of the volume of money, defined as currency outside banks plus demand deposits other than government or interbank deposits, to gross national product. The income figures are lagged one year and the interest rate is an average for the preceding twelve months. The method used to split the time period into shorter periods will be illustrated by an example. Fig. 5 shows a number of points relating the rate of interest ( $r$ ) to the Cambridge  $k$  ( $\frac{M}{Y}$ ).

Figure 5



The relationship which is consistent with Keynesian theory between the rate of interest and the Cambridge  $k$  is an inverse one. As was seen earlier<sup>19</sup> under most circumstances as the ratio of the quantity of money to the level of income increases, so idle balances will increase, and an increase in desired idle balances is associated with a fall in the rate of interest. Therefore where at least three points for consecutive years yield a negatively sloped curve when joined, Bronfenbrenner and Mayer assume that they are points on a single liquidity function. Thus all the years 1951 to 1955 in fig. 5 may be joined, but 1956 cannot be included. The three years 1956 to 1958 may be joined, but once again a break occurs for the year 1959. The points in fig. 5 give us three short-run functions according to the method of selection adopted by Bronfenbrenner and Mayer. The functions in fig. 5 indicate that three shifts have taken place in the function over the time period examined, each one being to the right of the previous one.

In the analysis of Bronfenbrenner and Mayer, eight separate curves appear. All points were included in one of these curves except for the years 1919, 1930-31 and 1946. This result is not surprising, as these are the years when marked shifts in the liquidity function, as it is being used here, would be expected. Idle balances are estimated using the maximum sample velocity method, and the process of fitting short-run functions is followed again, using interest rates but replacing the Cambridge  $k$  with deflated idle

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19. pp. 107-111 above.

balances, with the interest rate once again averaged over the preceding twelve months and idle balances lagged one year, six functions emerged with a single function covering the period 1932-41. However, there were more points which did not fall on any of the curves. As well as for the years in the first case, the points corresponding to the years 1929 and 1954-55 did not fall on any of the curves. The relationship between idle balances and interest rates shows a substantially higher interest-elasticity than is the case for the relationship between Cambridge  $k$  and interest rates. This is to be expected for the same reason that idle balances will be more sensitive to interest rate changes than will be total money holdings which include active balances which are not influenced by interest rate changes. However, Bronfenbrenner and Mayer find that the interest-elasticities of idle balances in the short-run functions are in general surprisingly low. It will be seen that a number of other studies also obtain results which reveal a lower elasticity of the demand for idle balances to changes in the rate of interest than expected. For example it is noted earlier<sup>20</sup> that Rousseas found that the demand for money lacked sensitivity to changes in the rate of interest, even at low interest rates.

The shifts in the liquidity function indicated by the different short-run functions drawn are quite marked, and appear to substantiate the hypothesis that definite shifts do occur in the liquidity function, but in between these shifts are periods of

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20. pp. 113-117 above.

relative stability in the Cambridge  $k$  - interest rate, or idle balances - interest rate, relationships. If we can develop a more satisfactory method of isolating periods over which the liquidity function does not shift then the method used by Bronfenbrenner and Mayer, the field of short-run analysis, may offer considerable scope for an increase in the precision and accuracy of knowledge surrounding the liquidity function, and could shed considerable light on the sorts of factors which lead to shifts in the function of the demand for money.

(ii) The implications of the results of the analyses of simple functions

It was seen in the second chapter that Keynes sought to explain desired money holdings in terms of the rate of interest on bonds and the level of money income. The relationship he postulated could be examined in two sections. First he postulated a constant linear relationship between money income and active balances. Second, the remainder of money holdings, which is termed idle balances, moves inversely with the rate of interest on bonds. Furthermore, in the second relationship the elasticity of desired idle balances will increase as the interest rate falls, becoming infinitely elastic at some low level of the interest rate. Also at some high rate of interest the demand for idle balances will become completely inelastic to further increases in the rate of interest. The same sort of statement applies to the demand for total money holdings, except that, for any rate of interest above that at which the demand for idle

balances and total money holdings becomes infinitely elastic to changes in the interest rate, the demand for total money holdings will be greater than the demand for idle balances.

A comparison of the Keynesian relationship as described with the results of the analyses so far considered may prove interesting. A number of features of the demand-for money function will be considered, keeping in mind that the interest rate used in all the analyses, except in the case of Latané's analysis, is a short-run rate in contrast to the long-run rate in the Keynesian relationship.

1. The inverse relationship between the rate of interest and the quantity of money of the Keynesian relationship is confirmed by all the analyses. With Tobin and Ritter the information available is not sufficient to determine whether the interest rate-demand for money relationship is interest-elastic or otherwise, although a 'reasonable' degree of elasticity is indicated by the grouping of the plotted points, particularly in Ritter's analysis. The curves drawn by Bronfenbrenner and Mayer and Rousseas indicate that the demand for money has an unexpectedly low interest-elasticity. However, Latané, who uses a long-term interest rate, finds that the demand for money has a high interest-elasticity.

2. Latané, Tobin and Ritter all support the liquidity trap hypothesis while the evidence of the other two analyses indicates that even at very low rates of interest the demand for money appears to be relatively inelastic to changes in the rate of interest. At

the other extreme all the analyses except that of Latané are in agreement with Keynes on the interest-inelasticity of the demand for money at high levels of the rate of interest.

On the points considered we can hardly say that strong support is provided by the analyses for the demand-for-money function postulated by Keynes. Generally the weight of evidence appears to be in favour, but the position can hardly be regarded as one of unanimity except on the inverse relationship between the demand for money and the interest rate and possibly on the inelasticity of the demand for money at high interest rates to changes in the rate of interest. Therefore it would appear that the demand-for-money function as postulated by Keynes does not exist as a clear and stable relationship on the basis of the analyses considered. However, it must be remembered that only one of the analyses used a long-term rate of interest, and generally they cannot be considered as completely searching investigations, particularly in the case of Tobin's and Ritter's analyses.

3. The final point to be considered is what evidence is provided to indicate the possibility of shifts occurring in the demand-for-money function. Tobin's analysis does not indicate a shift of the function, and Latané finds no evidence to support such a hypothesis. However both Rousseas and Bronfenbrenner and Mayer provide a considerable weight of evidence supporting the hypothesis, and Ritter's analysis indicates a strong possibility of a shift in the function. It would appear, particularly in view of the distinct

shifts illustrated in the analyses of Bronfenbrenner and Mayer that there is a very strong possibility of shifts occurring in the function. This factor, together with the often conflicting results of the analyses examined, indicates that the rate of interest and the level of money income may not be a complete explanation of the demand for money, although the results indicate that a significant relationship exists between these variables. The object of most of the analyses to be examined in the remainder of this chapter is to examine in greater detail the same basic function with additional explanatory variables included in order to obtain a more complete explanation of the demand for money. A few analyses discard the Keynesian relationship and seek the explanation of the demand for money in terms of other variables.

(iii) More complex functions

In this section we shall consider a number of studies which are basically of the Keynesian form with modifications taking the form of additional variables. Once again the functions which are used in the analyses use different dependent variables. Brown<sup>21</sup> and Bronfenbrenner and Mayer<sup>22</sup> concentrate upon idle balances. Khusro<sup>23</sup> and Turvey<sup>24</sup> are concerned with the rate of interest, and the

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21. Brown, A. J. Interest, Prices and the Demand Schedule for Idle Money (in Oxford Studies in the Price Mechanism, T. Wilson and P. W. S. Andrews (eds.) 1951, pp. 31-50).

22. Bronfenbrenner, M. and T. Mayer. Liquidity Functions in the American Economy (in Econometrica. Vol. 28: 810-834, 1960).

23. Khusro, A. M. An Investigation of Liquidity Preference (in York. B. Vol. 4, No. 1: 1-20, 1952).

24. Turvey, R. Interest Rates and Asset Prices. 1960.



dependent variable used by Selden<sup>25</sup> is the Cambridge  $k$ .

1. Interest rates on money substitutes and complements

Selden's analysis is not basically different from the simple interest rate - idle balances relationship, but because two separate rates of interest and real income per capita are included it warrants inclusion in this section.

(a) The basic function

He bases his investigations on a function of the form:

$$D_m = \frac{M}{PT} = D(r_m, r_{ms}, \frac{Y}{N}, E, U) \dots \dots \dots (13)$$

where  $D_m$  is the inverse of the transaction velocity of the circulation of total money holdings

$M$  is the quantity of money

$P$  is the level of prices

$T$  represents the volume of money transactions

$r_m$  is the long-term rate of interest

$r_{ms}$  is the difference between the long-term and short-term interest rates

$\frac{Y}{N}$  is real income per capita

$E$  is expectations

and  $U$  is tastes.

$r_{ms}$  as defined measures the cost of holding money substitutes in the same way that  $r_m$  measures the cost of holding money. As  $r_{ms}$

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25. Selden, R. T. Monetary Velocity in the United States (in Studies in the Quantity Theory of Money, M. Friedman (ed.) 1956, pp. 179-257).

increases the demand for money should increase since as the cost of holding money substitutes increases it becomes a less attractive proposition to hold money substitutes rather than money. The long rates indicate the value placed on liquidity (the cost of holding money), while short loans, being a close substitute for money, must influence the demand for money as their rate varies relative to long rates. Given the relative liquidities of money and money substitutes, changes in the cost of holding money substitutes, as measured by the difference between long-term and short-term rates, will tend to lead to shifts from money substitutes into money or vice versa. An increase in the rate of interest on money substitutes, given the long term rate of interest, will tend to reduce the demand for money and increase the demand for money substitutes, as the reward for shifting into money substitutes and out of money would have increased, provided that the relative liquidities of the two assets remained unchanged. Therefore, the cost of holding money substitutes and the demand for money should move in the same direction. Selden states that "According to conventional price analysis, the demand for any commodity increases (decreases) if prices of close substitutes rise (fall) and decreases (increases) if prices of close complements rise (fall)."<sup>26</sup> The inclusion of real income per capita is justified by Selden because "... the proportion of income he (the individual) consumes by providing for anticipated or contingent

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26. Monetary Velocity in the United States. p. 209.

cash needs probably will vary with the level of his income."<sup>27</sup> He maintains that the demand for money relative to total transactions will increase as real incomes increase. The variable  $\frac{Y}{N}$  may be reflecting in part the asset demand for money as described in the previous chapter,<sup>28</sup> since income per capita and total assets would be expected to move together.

(b) The estimates

Selden traces the course of the velocity of circulation of money in the U.S. for the period 1919 to 1951. He examines both income velocity and transactions velocity expressed as the ratio of deposit turnover to the quantity of money. The reason for switching from the Cambridge  $k$ , which he uses in the discussion prior to the empirical tests, to its reciprocal the velocity notion is not specified. In the case of both income and transactions velocity linear functions are fitted, but the method of estimation used is not stated. The explanatory variables in both cases are the cost of holding money, real income per capita and the cost of holding money substitutes. The quantity of money is defined as currency outside banks, and all deposits, including U.S. government holdings of "Treasury cash" and deposits in all banks. Transactions velocity is the ratio of debits to all accounts other than interbank deposits to total deposits. Income is taken as national income less non-monetary

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27. Monetary Velocity in the United States. p. 205.

28. Chapter 3, pp. 64-76 above.

income, and the interest rates used were rates on long-term loans, which were adjusted for the rates paid on interest-bearing deposits, and for price level changes, and short-term loans. The cost of money substitutes is represented by bond yields minus rates on four-to-six month commercial paper. The variables expectations and tastes are not included in the estimated functions because they are not objective variables, and cannot be satisfactorily represented in numerical terms.

(c) Comparison of actual and expected results

As has already been noted<sup>29</sup> the cost of holding money will move inversely with the quantity of money, and the cost of money substitutes and real income per capita will move directly with the quantity of money. Selden holds that money is a superior good and therefore the demand for it will increase as real incomes increase. It has been illustrated<sup>30</sup> that under most circumstances an increase in velocity will be accompanied by a reduced demand for idle balances. Therefore we can expect the cost of holding money to move directly with changes in velocity, and real income per capita and the cost of money substitutes will move inversely with velocity under most circumstances.

In the estimated transactions velocity function the signs are as expected except for the cost of holding money which is inversely related. However, the cost of holding money has only a low partial

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29. pp. 130-131 above.

30. pp. 107-111 above.

correlation coefficient, while those for the other two variables are high. Real income per capita has a partial correlation of 0.83 with transactions velocity and that for the cost of money substitutes is 0.90. The multiple correlation coefficient is high at 0.94, and if the relationship is estimated without the cost of holding money, the multiple correlation coefficient is only slightly lower at 0.92. Thus it would appear that some doubt must be attached to the significance of the cost of holding money for desired transactions velocity, and that the explanation for velocity movements is largely explained by the cost of money substitutes and real income per capita, particularly the former.

Further empirical tests undertaken by Selden lend support to these conclusions. The relationship between the cost of holding money and desired velocity does not increase markedly in its significance even when the interest rates used are adjusted for the yield on money (interest rates on savings deposits) and for price level changes. Equity yields are tested, also with adjustments for price level changes, as a measure of the cost of holding money. With further adjustments to yields for capital gains as a result of share-price increases, an effective yield on equities is obtained, and this variable proved to be related inversely with the demand for money, and more closely than other measures of the cost of holding money. However, in whatever form it is used, the cost of holding money is overshadowed by the cost of money substitutes. The variable real income per capita appears to be significant but is not as important in explaining velocity changes as is the cost of

money substitutes.

A lengthy examination of data relating to income velocity changes over the period 1839-1951 is conducted.<sup>31</sup> From this examination Selden concludes that for secular movements in the demand for money, the level of real income per capita appears to be the most important explanatory variable particularly in the period prior to 1919. For short-run or cyclical movements in the demand for money easily the most important of the variables considered is the cost of money substitutes. However, this variable certainly does not provide a complete explanation of cyclical changes in the demand for money, and Selden suggests that subjective variables such as tastes and expectations, particularly the latter, may be equally important. Also it is interesting to note that over this period Selden found closer correlations were obtained using transactions velocity rather than income velocity. The apparent explanation for this lies in variations in the proportion of total transactions which will influence money requirements, but which will not be reflected in the level of income.

The general conclusions of the analysis are that the explanation of changes in the demand for money, and in income and transactions velocities lies primarily in the cost of money substitutes, particularly for cyclical movements and for the period 1919-1951. The variable real income per capita is also important particularly for the period 1836-1919, and basically in explaining

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31. Monetary Velocity in the United States. pp. 218-233.

secular movements in velocity and the demand for money. The other interesting conclusion of the analysis is that the cost of holding money as measured by the adjusted yield on long-term securities has played a minor role in velocity movements in the U.S.

## 2. Prices

In this section the examination focusses upon the addition of the price variable to the Keynesian demand-for-money function. In many analyses the price level is used to deflate the money values of other variables. However, it is not in this simple adjustment sense that the price factor is to be considered here. The current rate of change of prices is an indicator of expected future changes, and therefore of the expected appreciation or depreciation of money in terms of its purchasing power. In the majority of analyses the price variable in this sense is ignored except for special studies of the demand for money pertaining to periods of monetary crisis such as that carried out by Cagan.<sup>32</sup> Under such circumstances the price level is changing so rapidly that it becomes of overwhelming importance; however, most studies concerned with analysing the demand for money under fairly "normal" conditions pay little attention to prices. The most important exception is that of Brown.<sup>33</sup>

As dependent variables Brown uses both idle balances and total deposits of the clearing banks, concentrating particularly

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32. Cagan, P. The Monetary Dynamics of Hyperinflation (in Studies in the Quantity Theory of Money, H. Friedman (ed.) 1956, pp. 25-117).

33. Interest, Prices, and the Demand Schedule for Idle Money.

upon the former. He sets out to show that Keynes' liquidity preference schedule is a potentially useful empirical relationship and that with the inclusion of the price variable, it remains fairly stable over time. The analysis pertains to the period 1921-1936 in the U.K. Estimates of idle balances were obtained in the manner indicated earlier,<sup>34</sup> and then the following relationships were examined:

$$D = a + br + cP' \quad \dots \quad \dots \quad \dots \quad (14)$$

$$M = d + eD + fP' \quad \dots \quad \dots \quad \dots \quad (15)$$

$$M = g + hr + iP' \quad \dots \quad \dots \quad \dots \quad (16)$$

$$M = j + kD + lP' \quad \dots \quad \dots \quad \dots \quad (17)$$

$$D = m + nr + oP' + pP' \quad \dots \quad \dots \quad \dots \quad (18)$$

$$M = q + sr + tP' + uP' \quad \dots \quad \dots \quad \dots \quad (19)$$

where  $D$  is the total deposits of the clearing banks

$r$  is the yield on  $2\frac{1}{2}\%$  Consols

$P'$  is the current value of an index of wholesale prices minus its value for the previous year

$M$  is idle balances held with the clearing banks

and  $r'$  is the current value of the rate of interest ( $r$ ) minus its value for the previous year.

The series on total deposits of the clearing banks is not a series on total money holdings, but is taken to be representative of total money holdings: "... most of the remainder of the country's 'total money' may be assumed without risk of serious error to vary in

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34. pp. 99-101 above.



much the same way as these deposits."<sup>35</sup> The yield on  $2\frac{1}{2}\%$  Consols represents the cost of holding money and is assumed to be inversely related to both desired money holdings and desired idle balances.  $r'$  is included as an indicator of expectations of changes in the rate of interest and therefore  $r'$  and desired idle balances should be inversely related. Brown suggests that the rate of interest may be highly stable so that a rise in the rate over the previous year induces an expectation of a fall in the rate, so that money holdings will be reduced in anticipation of the fall. This explanation is consistent with the Keynesian theory of the influence of the rate of interest.<sup>36</sup> If  $r'$  increases this means  $r$  must also have increased, and any increase in  $r$ , given the 'normal' rate of interest, will strengthen expectations of a fall in this rate. The greater is the increase in the rate of interest the stronger become expectations of a fall. The variable  $P'$  is included as a measure of the rate of depreciation of money holdings measured in real terms. This relationship is discussed fully earlier in this thesis.<sup>37</sup> It was seen that the rate of increase of commodity prices and the demand for money would be inversely related. The higher the rate of increase in prices the lower the demand for money since losses in real terms will be sustained by holding money, and these losses will be higher the larger are the money holdings and the higher the rate of change

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35. Interest, Prices, and the Demand Schedule for Idle Money, p. 32.

36. In Chapter 2, pp. 31-34 above, the influence of interest rate expectations upon the demand for money is discussed at length.

37. Chapter 3, pp. 77-79 above.

of prices.

Of all the relationships fitted (the method of estimation used is not noted) those where idle balances were used in preference to total deposits yielded closer statistical fits. Thus the connection with the variables  $r$ ,  $r'$  and  $P'$  appears to be between these variables and idle balances rather than with total deposits. Multiple correlation coefficients are very satisfactory, being of the order of 0.9. In all the regressions (14) to (19) the signs of the estimated parameters conform to expectations.  $P'$ ,  $r$  and  $r'$  reveal inverse relationships with both  $M$  and  $D$ . Generally however  $r'$  is not nearly as closely related to  $M$  or  $D$  as the other explanatory variables. The inclusion of the variable  $r'$  must duplicate the rate of interest to a considerable extent, since the latter is itself a measure of expectations as well as of the cost of holding money, and movements in  $r'$  are likely to reflect changes in  $r$  fairly closely. It would therefore appear that the variable  $r'$  can succeed in doing little more than the rate of interest itself as an indicator of expectations. The closest of all the relationships Brown found to be clearly that between idle balances, the rate of interest and the rate of change of prices. Using the 't' test the variables  $P'$  and  $r$  prove to be significant at both the 1% and 5% levels of significance. Thus Brown finds that the rate of change of prices and the rate of interest provide a very satisfactory explanation for the demand for idle balances in the U.K. for the period examined. His results confirming the Keynesian hypothesis

regarding the interest rate - idle balances relationship are in direct opposition to the results of Selden's analysis.<sup>38</sup> Perhaps the most interesting feature of the analysis is the inclusion of the rate of change of prices as a variable and its high negative correlation with idle balances. The relationship of this variable with idle balances is close, although not as close as that of interest rates with idle balances. The negative correlation of rates of price change with money conforms to expectations. Therefore, the analysis provides strong support on empirical grounds for the theoretical notion discussed in the previous chapter<sup>39</sup> that the expected rate of change of prices, as a measure of the expected depreciation of money holdings in real terms, is an important determinant of the demand for money in 'normal' circumstances as well as in periods of monetary crisis.<sup>40</sup>

### 3. Assets

The total volume of assets may be a significant determinant of the demand for money, as every asset involves contingent liabilities, in anticipation of which money must be held. Also as the wealth of an individual increases he will be better able to afford to hold more money than previously. Given the rate of return

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38. pp. 129-135 above.

39. Chapter 3, pp. 76-81 above.

40. It must be noted, however, that although Brown's analysis was not intended as an examination of the demand for money in a period of monetary crisis, in the period examined (1921-36) there were significant periods of considerable price fluctuation.

on assets the income foregone in absolute terms will be the same if he increases his money holdings by a given amount, no matter what his total asset holdings are. However, in relative terms the loss of income will be smaller the larger his asset holdings. A number of analyses investigate the possibility of total assets as a determinant of the demand for money. These may be divided into two groups. The first group consists of three analyses which use both interest rates and total assets to explain the demand for idle balances. Khusro<sup>41</sup> is basically concerned with the relationship between assets, idle balances and the long-term rate of interest with the last as the dependent variable. He also investigates this relationship modified by the inclusion of a three-year moving average of Consol prices and of an index of net dividends declared. Bronfenbrenner and Mayer<sup>42</sup> use both idle balances and total money holdings as dependent variables and the explanatory variables tested are the short-term interest rate, national wealth, gross national product and both idle balances and total money holdings lagged one year. The third analysis in this group is that of Turvey.<sup>43</sup> The dependent variable in Turvey's analysis is the yield on obligations of the Federal Government in the U.S. As explanatory variables he is concerned with money income, the quantity of money and quantities of other asset types and their prices. The second

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41. Khusro, A. M. An Investigation of Liquidity Preference (in York. B. Vol. 4, No. 1: 1-20, 1952).

42. Bronfenbrenner, M. and T. Mayer. Liquidity Functions in the American Economy (in Econometrica. Vol. 28: 810-834, 1960).

43. Turvey, R. Interest Rates and Asset Prices. 1960.

approach under this section on assets is adopted in only one of the analyses to be considered. This analysis is considered by Iydtall<sup>44</sup> and the striking feature is the dismissal of the rate of interest as a variable explaining the demand for money and the concentration solely upon assets as the explanatory variable.

(a) Assets and interest rates

Khusro sets out to derive a liquidity preference schedule for the period 1919 to 1948 in the U.K. With little introduction the variable total assets is incorporated in the liquidity function. The relationship actually used was of the form

$$r = a - b \frac{M_2}{A} \quad \dots \quad \dots \quad \dots \quad (20)$$

where  $r$  denotes the rate of interest

$M_2$  denotes idle balances

and  $A$  denotes total assets.

The logic of the relationship can be seen more readily when stated as:

$$M_2 = \frac{A(a - r)}{b}$$

From this relationship it can be seen that idle balances and total assets will be directly related while idle balances and the rate of interest will be inversely related. The justification undertaken by Khusro for relationships of this nature on a priori grounds is limited, but follows along the lines presented in the previous chapter.

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44. Iydtall, H. F. Income, Assets and the Demand for Money  
(in Rev. Econ. Stats. Vol. 40: 1-14, 1958).

The relationships actually fitted are:

$$r = a + b \frac{M_2}{A} \quad \dots \quad \dots \quad \dots \quad (21)$$

$$r = c + d \frac{M_2}{A} + e C \quad \dots \quad \dots \quad \dots \quad (22)$$

$$r = f + g \frac{M_2}{A} + h D' \quad \dots \quad \dots \quad \dots \quad (23)$$

where  $r$  is the yield on Consols net of investment and disinvestment costs and the marginal tax rate

$M_2$  is currency plus current accounts less active balances estimated by the regression method<sup>45</sup>

$A$  is a range of assets from government securities to company debentures measured at par values

$C$  is a three-year moving average of Consol prices

and  $D'$  is an index of dividend rates declared adjusted for marginal rates of tax.

The figures relating to total assets are not comprehensive due to limited information. A preliminary investigation revealed a closer relationship between idle balances and the adjusted rate of interest than between idle balances and the unadjusted rate, therefore in the regressions (21) to (23) the adjusted rate was preferred to the unadjusted rate. In (22) the variable  $C$  was included because the deviations of the series for net yield on  $2\frac{1}{2}\%$  Consols estimated from (21) from the series for actual net yield revealed a pronounced

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45. pp. 97-98 above.

inverse correlation when plotted on a graph. The a priori justification for the inclusion of C is that past changes in Consol prices play a significant and consistent role in determining expectations about future prices and thus is designed to account for expectations of capital appreciation or depreciation. However the correlation between Consol prices and the deviations is suspect. If the deviation of actual from estimated net yield moves from zero in any year to some positive amount, provided no change has occurred in the estimated yield, the deviation must be the result of an increase in the actual yield. An increase in the actual yield reflects a fall in Consol prices, and so a fall in the three-year moving average of Consol prices. Thus an inverse correlation between a three-year moving average of Consol prices and deviations of estimated from actual net yield may merely reflect the inverse association of the price of an asset and its yield and have no economic significance whatever. The other possibility examined by Khusro is the net return on equity investment. Money and bonds are not the only alternative as a means of holding wealth open to an investor. There is also the field of equity investment. A rise, or the expectation of a rise in the yield on equities is, *cet. par.*, likely to lead to a shift into equities from bonds and money. As an indicator of this factor, an index of dividends declared, net of the marginal tax rate, is taken. The index of dividends declared is a supplementary variable to the net yield on Consols in that each measures the reward for holding a particular asset type, and

tends also to act as a measure of expectations about the future prices of these assets. Khusro therefore anticipates that  $r$  and  $D'$  will be directly related.

The multiple correlation coefficients for all three regressions are high, particularly for (22) and (23). They were respectively: 0.85, 0.93 and 0.97. The closeness of the fit is improved even more by the inclusion of the variable  $D'$  than is the case for  $C$ . On these grounds Khusro appears to be justified in including either or both of these variables in the regression. In all the regressions the estimates yielded relationships with the net yield on 2½% Consols as expected on a priori grounds. The ratio of  $\frac{M_2}{A}$  is inversely related to  $r$  as is  $C$ , while  $D'$  is directly related to  $r$ .

The significant feature emerging from Khusro's analysis is the strong empirical support provided for the relationship between the rate of interest, total assets and idle balances. The support for the interest rate - idle balances relationship contrasts with the conclusion which Selden's analysis led to.<sup>46</sup> Also the analysis by Khusro indicates that something may be gained from including more than one rate of interest in the liquidity preference schedule as demonstrated in regression (23).

Another analysis which is closely related to that of Khusro, in that it explains the demand for idle balances in terms

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46. pp.129-135 above.



of interest rates and total assets, is the analysis of Bronfenbrenner and Mayer<sup>47</sup> for the U.S. for the period 1919-1956. They seek to obtain a more useful function than the simple idle balances - interest rate relationship, measuring usefulness by the closeness of the statistical fit. Two dependent variables are used in the analysis. These are desired idle balances and desired total money holdings. The relationships fitted (the method of estimation is not mentioned) are:

$$X_{1a} = a + bX_2 + cX_3 + dX_4 \quad \dots \quad \dots \quad \dots \quad (24)$$

$$X_{1b} = e + fX_2 + gX_3 + hX_5 + iX_6 \quad \dots \quad \dots \quad \dots \quad (25)$$

where  $X_{1a}$  is the log of estimated idle balances adjusted for changes in the price level. Idle balances are estimated by the maximum sample velocity method,<sup>48</sup> using income (as distinct from transactions) in estimating active balances.

$X_{1b}$  is the log of total money holdings defined as currency outside banks plus demand deposits other than government or interbank deposits.

$X_2$  is the log of the rate of interest on four-to-six months commercial paper.

$X_3$  is the log of national wealth in 1929 prices. Wealth of the government sector is included to represent holdings of government securities by the private sector which would otherwise be neglected.

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47. Liquidity Functions in the American Economy.

48. pp. 93-96 above.

$X_4$  is the log of idle balances with a time lag of one year.

$X_5$  is the log of total money holdings lagged one year.

$X_6$  is the log of gross national product.

The selection of a short-term interest rate is in direct contrast with the long-term rate in the Keynesian function. The four-to-six months commercial paper rate is chosen because it is virtually free of risk and appreciation in most circumstances and because it is regarded as a more sensitive rate to changes in economic conditions than any other. It appears that the rate of interest is being included only as a measure of the cost of holding money and that the influence of expectations about the rate of interest on the demand for money are being ignored. However, variations in short and long-term rates of interest tend to follow the same pattern, so that the short-term rate, though perhaps not as good an indicator as the long-term rate, does serve to measure expectations about the future level of asset prices. The second regression (25) involves the regression method for estimating idle balances,<sup>49</sup> although the estimated parameter of  $X_6$  is not actually used to derive an estimated series on idle balances.

As indicated, both the regressions fitted are linear functions relating the log values of the variables. Thus the slope coefficients are all elasticities.<sup>50</sup> The elasticities of the

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49. pp. 97-101 above.

50. This may be illustrated by an example. The relationship:

variables in both functions are as expected with one exception. The interest rate yields a negative elasticity and private gross national product and prior year idle balances reveal positive elasticities. The exception is the elasticity of total national wealth. In the first function this variable yielded a positive elasticity as expected, but in the second function its elasticity was negative. Also the results of statistical tests applied were not satisfactory in the case of the wealth variable. The wealth variable is the only one in the regressions which does not prove to be significant by the 't' test at the one percent level. Bronfenbrenner and Mayer suggested that the negative elasticity of wealth and money may be explained by money being an inferior asset. This possibility has already been commented on in the previous

$\log X_1 = \log a + b \log X_2 + c \log X_3$  may be expressed as

$$X_1 = aX_2^b X_3^c$$

The partial derivative of this expression with respect to  $X_2$  is  $\frac{\partial X_1}{\partial X_2} = aX_3^c bX_2^{b-1}$

The elasticity of  $X_1$  to changes in  $X_2$  is given by:

$$\begin{aligned} \frac{EX_1}{EX_2} &= \frac{X_2}{aX_2^b X_3^c} \cdot \frac{\partial X_1}{\partial X_2} \\ &= \frac{X_2}{aX_2^b X_3^c} \cdot aX_3^c bX_2^{b-1} \end{aligned}$$

The right hand side of this expression simplifies to 'b'. Thus the parameters of a logarithmic function are elasticities.

chapter.<sup>51</sup> However, such an explanation still does not account for the contradictory results obtained in the two functions. The general conclusion must be that the results of the analysis provide little evidence in support of total assets as a variable of importance in influencing the demand for money.

Bronfenbrenner and Mayer introduced the variable prior year idle balances to reflect demand inertia. They suggest that this variable may in fact reflect supply conditions, rather than demand inertia. The close relationship between current and prior year idle balances may merely reflect the reluctance of the monetary authorities to permit excessive fluctuations in the money supply. Therefore the regressions are fitted excluding prior year idle balances:

$$X_{1a} = j + kX_2 + lX_3 \quad \dots \quad \dots \quad \dots \quad (26)$$

$$X_{1b} = m + nX_2 + oX_3 + pX_6 \quad \dots \quad \dots \quad \dots \quad (27)$$

The same elasticity estimates emerge from these two regressions as from (24) and (25). Once again the wealth variable has a negative elasticity in the function for total balances, but the estimate again is not significant by the 't' test. The estimated interest elasticities in both regressions are more than double those in the regressions (24) and (25). The multiple correlation coefficients are not a great deal lower for the last two regressions. The most

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51. Chapter three, pp.64-67.

marked is the fall in the multiple correlation coefficient for the idle balances function from 0.90 to 0.85. In both sets of estimates the interest-elasticity of the demand for money is lower in the function for total balances than in that for idle balances alone, indicating that it is the idle portion of total balances which is interest-elastic. Bronfenbrenner and Mayer mention in a footnote<sup>52</sup> that three other variables - lagged interest rates, lagged national wealth and the rate of change of the price level - were considered but rejected because of their poor correlations with idle balances. The conclusion with regard to the rate of change of prices is in direct contrast to the finding of Brown examined earlier<sup>53</sup> who included the rate of change of prices as one of two main explanatory variables of the demand for idle balances.

The analysis indicates that the total stock of wealth as a variable explaining the demand for money is of doubtful importance. The variable prior year idle balances appears to be closely related to the demand for idle balances. However this relationship is suspect in that it may be reflecting supply conditions rather than demand inertia. It would therefore appear that the burden of explaining the demand for idle balances rests largely

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52. Liquidity Functions in the American Economy, see footnote 19, p. 814.

53. pp. 135-139 above.

with the short-term rate of interest. Bronfenbrenner and Mayer also consider the liquidity trap hypothesis.<sup>54</sup> They tested the hypothesis that the elasticity of the demand for idle balances is greater at low interest rates than at high rates. A series of figures on the interest elasticity of the demand for idle balances was correlated with interest rates. Not only is the resulting correlation coefficient small, but it has a positive sign. If anything, therefore, the indication of the correlation is that the elasticity of the demand for idle balances to changes in the rate of interest increases as the rate of interest increases. Certainly the correlation does not provide evidence supporting the liquidity trap hypothesis.

Bronfenbrenner and Mayer admit that the liquidity trap as a limiting case is a reasonable hypothesis, but conclude from the evidence that perhaps the rate at which the demand for money shows a marked increase in its elasticity to interest rate changes is so low that it is beyond the range of observed rates, and thus the liquidity trap is not significant in fact:

"... the absence of a negative correlation (between the interest-elasticity of the demand for money and the rate of interest) in a period when interest rates were at times quite low casts doubt on, if not the truth, then at least the relevance of the liquidity trap proposition ..."<sup>55</sup>

The third analysis to be considered is that by R. Turvey,<sup>56</sup>

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54. Liquidity Functions in the American Economy, pp. 831-833.

55. Liquidity Functions in the American Economy, p. 831.

56. Interest Rates and Asset Prices.

who examines the relationship between the distribution of assets amongst the different asset forms including money, the prices (or interest rates) of these assets, and income. Total assets would have been considered also, but no satisfactory series was available for this variable. The variable income is taken to be representative of assets as well as transactions. The quantity of money demanded varies with the total volume of assets, the distribution of the total between the various asset types, and the prices of the different assets.

The relationship which is the basis of Turvey's analysis is:  $r = f(M, Y)$

where  $r$  is the rate of interest

$M$  is the quantity of money

$Y$  is national income.

It is noticeable that the dependent variable is the rate of interest. The position is clarified by the statement: "The rate of interest, we can say, is a function of the quantity of money and the national income. Now this is nothing but the liquidity preference theory of interest expressed as briefly as is possible."<sup>57</sup> Thus the relationship used by Turvey is simply an alternative expression of the Keynesian relationship:

$$M = f(Y, r).$$

When the relationship is expressed in the form used by Turvey it can be seen that the dependent variable will be influenced by other

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57. Interest Rates and Asset Prices, p. 19.

factors than M and Y. There is no single rate of interest and whichever rate is chosen as the dependent variable will be influenced by other interest rates and also by the quantities of different types of assets. This assumes that asset holders will be faced with a range of market possibilities and their selection will depend upon the relative returns upon the different asset types. Thus if other interest rates rise, the dependent variable will also rise to maintain the uniformity of rates. Furthermore it can be seen that if the demand for an asset is elastic to changes in the quantity of it then the quantities of different types of assets will be variables relevant to the function. Not only will changes in the quantity of money lead to changes in interest rates, but also changes in the total quantity of assets other than money and in the distribution of the total between the different asset types will lead to changes in interest rates. The relationship may be expressed in terms of any one of the assets or their prices. For example, we may say that the rate of interest (the price of) asset A varies with the total volume of assets, its distribution between the different types of assets including A, and the prices of all the other assets.

In Turvey's empirical analysis<sup>58</sup> the monetary sector is defined as the Federal Government, commercial banks, and the Federal Reserve system. The private sector is the rest: households, state and local government, financial intermediaries and the rest of the

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58. Interest Rates and Asset Prices, pp. 60-78.



world. The variable to be explained (I) is the average yield to maturity on Federal obligations held by the private sector. The independent variables considered are:

M - the sum of the quantity of money and the amount of savings bonds outstanding less the amount of bank loans outstanding

FO - the quantity of Federal obligations outstanding

LTD - the monetary sector's holding of long-term debt

G - an estimate of government guarantees of private debt

Q - an average of interest rates on time deposits and short-term business loans made by banks and the yield on savings bonds

Y - national income

P - an index of prices

T - the annual rate of turnover of demand deposits except interbank and government deposits in the last month of the quarter.

According to Turvey the probable nature of the relationships between the dependent variable and the explanatory variables is as follows: The average yield on Federal obligations will be lowered by: (1) an increase in the quantity of money and the amount of savings bonds less the amount of bank loans outstanding - thus the usual inverse relationship between money and interest rates is postulated.

(2) a reduction in the quantity of Federal obligations outstanding. Such a reduction would be effected by the monetary sector buying from the private sector. The effect of this buying pressure would be to push the prices of Federal obligations up and consequently their

yield will fall.

(3) an increase in the holding of long term debt of the monetary sector. The holdings of long term debt by the private sector are reduced and the price increased, and since Federal obligations are a substitute for long-term debt their price will increase also (interest rate will fall).

(4) a reduction in the rates of interest paid on time deposits, postal savings deposits and savings bonds, and the rates charged on bank loans. A reduction in these rates makes the private sector less inclined to hold money as the return on it is reduced. Given the existing quantity of money it will only be held willingly if the rate of return on Federal obligations falls, so reducing the cost of holding money.

(5) a reduction in national income. If income falls the demand for active balances falls and therefore so does the demand for money, so that interest rates will fall unless the quantity of money is reduced.

(6) a fall in the annual rate of turnover of demand deposits. This will have the same effect as (5) of reducing the need for active balances. Consequently idle balances will increase and interest rates will fall. The variable  $G$  is not dealt with separately but is added to both  $FO$  and  $LTD$ . The variable  $P$  is used to deflate the money values of the variables in some of the regressions fitted.

Turvey also examines a number of factors which may cause

shifts in the demand function:

(1) Because an increase in the income from real assets increases the yield on real assets, such an increase will lead to a shift from other assets since their yield becomes relatively lower, thus reducing the demand for money and increasing interest rates. The yield on Federal obligations, given the same quantities of Federal obligations, long-term debt and money will be higher than previously.

(2) Expectations may change. The portfolio distribution of an individual and changes in it will depend not only upon the current yields of the different assets, but also on expected future yields. Thus if yields are expected to increase on all assets relative to money, although current yields remain unchanged, the individual will tend to reduce his current asset holdings to avoid capital losses. Thus without any changes in the quantity of money or other asset types the yield on Federal obligations will rise - the function will have shifted upwards. The example used by Turvey portrays this sort of shift well: "Where, for instance, scepticism about a cheap money policy turns into a conviction that the monetary authorities are going to succeed in achieving their aims for some years, the demand for Federal obligations will be raised."<sup>59</sup>

(3) Of significance probably only over long periods is the development of new financial institutions and new forms of debt within the private sector. The introduction of new assets will

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59. Interest Rates and Asset Prices, p. 67.

tend to lead to a reduced demand for other assets and thus a fall in their prices. The price of Federal obligations will fall along with other assets. Therefore we have under these circumstances an increase in the yield on Federal obligations without any change in the explanatory variables in the function.

(4) Since the convenience yield on money is not taxed but incomes and capital gains are in the U.S., a change in tax rates will alter the relative attractiveness of the different asset types.<sup>60</sup> The resulting changes in the demand for different assets will lead to changes in their prices. Thus again the yield on Federal obligations will alter again without any impetus from the explanatory variables in the function.

Turvey examines quarterly data for the U.S. for the period 1945-1957. The basic functions fitted relate the yield on Federal obligations (I) to:

- (1)  $M$ ,  $FO + G$ ,  $LTD + G$  and  $Y$  all valued at 1954 prices.
- (2)  $FO + G$ ,  $LTD + G$  and  $Y$  all expressed as a ratio of  $M$ .
- (3)  $FO + G$ ,  $LTD + G$  and  $M$  all expressed as a ratio of  $Y$ .

Further regressions of the above forms were fitted including as additional variables either, or both of the variables  $Q$  and  $T$ .

Multiple correlation coefficients were high for all the regressions

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60. Some analyses such as Khusro's (see above pp. 141-144 ) calculate the rate of interest net of taxation in an attempt to eradicate this source of shifts in the demand-for-money function.

being of the order 9.2 to 9.6. The variables were in all cases correlated with the yield on Federal obligations in the manner indicated above.<sup>61</sup> Thus the empirical analysis provides strong support for the hypotheses formulated by Turvey, indicating a significant relationship between interest rates, income, quantities of different types of assets and the quantity of money.

(b) Assets alone

We come finally to H. F. Lydall.<sup>62</sup> His analysis for the U.S. corresponds to the preceding three analyses in that it includes total assets in a demand-for-money function,<sup>63</sup> but differs in that the asset variable is used to provide the whole explanation of changes in the demand for idle balances:<sup>64</sup>

"... the entire phenomenon of the interest-elasticity of demand for money can be explained in terms of a "precautionary" - or "asset" - demand for money which is governed by the current market value of total assets."

Savings Survey data for 1954 provided the essential information for this analysis which is confined to the personal sector, and concerned therefore only with the income, money and asset holdings of individuals. The relationship postulated by Lydall uses liquid

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61. Positive for the quantity of Federal obligations, income, transactions and the interest yield on money, and negative for the quantity of money and the quantity of long-term debt held by the monetary sector.

62. Income, Assets, and the Demand for Money.

63. The inclusion of assets in the demand-for-money function is considered in the previous chapter, pp. 64-76 above.

64. Income, Assets, and the Demand for Money, p. 2.

assets as the dependent variable, and income and net worth are the explanatory variables. A linear relationship between these variables was fitted. The net worth or assets variable included all assets of individuals except for: durable consumer goods other than cars and houses; cash in hand and the capital value of life insurance policies and pension rights. From the total assets obtained, any liabilities (bank overdraft, mortgages etc.,) were deducted and thus the net worth figure was arrived at. Liquid assets were taken as: bank and savings bank deposits, shares and deposits in building and co-operative societies, and certain most-liquid government securities.

A chart plotting the series of figures on liquid assets per income unit and net worth per income unit reveals that the proportion of net worth held in liquid form is high until liquid assets reach about two hundred pounds perhead.<sup>65</sup> Then for groups above this level, the proportion of marginal net worth retained in liquid form appears to be about one-sixth. Thus individuals with total assets of about £240 could be expected to hold all but £40 in liquid form. On the other hand an individual whose total assets are £1400 would hold a basic £200 in liquid form and of the remaining £1200 about one-sixth or £200 will be held in liquid form so that his total liquid asset holdings will be £400.

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65. Income, Assets, and the Demand for Money, p. 6.

Lydall suggests on the basis of this chart that each income unit seeks to accumulate liquid assets of about two hundred pounds, and that this is essentially an income demand for liquid assets. Beyond the two hundred pounds, the increase in money holdings in the ratio of one to six to increases in total assets is the asset demand.

These results indicate that income and assets may be closely related to the demand for liquid assets. He therefore fits the relationship:

$$X_1 = a + bX_2 + cX_3$$

where  $X_1$  is liquid assets

$X_2$  is net worth

$X_3$  is gross income

When fitted this relationship showed, as expected, a very strong positive correlation between the demand for money and total assets. It also showed an inverse relationship between the demand for money and income, but this result was not statistically significant. Hence Lydall concluded that there is no apparent relationship between the demand for money and income in his analysis when different groups of people are compared at the same point of time. As he points out, this is a different proposition from stating that any particular individual does not vary his demand for money as his income varies over time. Similar reasoning may be applied to the conclusions about net worth. The results of the analysis indicate that different quantities of money are held by different individuals at different

levels of net worth. Although the results indicate a consistent relationship between the demand for money and net worth, they do not necessarily mean that a particular individual or group of individuals will vary their desired money holdings in the same manner with changes in their net worth over time. However, if we accept the proposition that changes in the net worth and money holdings of a community follow the same pattern over time as is apparent between different groups of individuals at a point of time, then Lydall's results can be accepted as significant. If accepted, his results tend to reinforce his theoretical proposition that the demand for money can be explained chiefly in terms of the level of assets, although certainly there is considerable room for doubt. Firstly the other analyses considered in this chapter, although they generally find total assets significant as an explanatory variable, they do not find that it provides anything approaching a complete explanation of the demand for money. Secondly we have seen in the previous two chapters that good a priori reasons exist for the belief that variables such as income, interest rates<sup>66</sup> and the rate of change of prices are important determinants of the demand for money.

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66. On Lydall's indirect method of taking into account the rate of interest (see pp. 71-76 Ch. 3). Bronfenbrenner and Mayer comment in a footnote, p. 818, that their correlations between observed wealth and interest rates, "while negative, are so low ... as to cast doubt on the efficacy of Lydall's indirect method ...". There would have to be a high degree of correspondence between interest rates and total wealth for the rate of interest to be taken into account indirectly via the wealth variable.



(c) Permanent income

A study involving a concept closely allied to the asset-demand for money is that by Friedman.<sup>67</sup> His survey covers the period 1870 to 1958 in the U.S. Friedman holds that the rate of interest will not explain the changes in the demand for money which are not explained by changes in current income. The analysis rests on the two basic concepts of permanent income and permanent prices. "The concept of permanent income is .... hard to define precisely."<sup>68</sup> Friedman treats measured income as consisting of the two components permanent and transitory income. "The permanent component is to be interpreted as reflecting the effect of those factors that the unit regards as determining its capital value or wealth..... The transitory component is to be interpreted as reflecting ... factors that are likely to be treated by the unit affected as "accidental" or "chance" occurrences..."<sup>69</sup> The notion of permanent prices is analogous. Permanent prices relate to longer-term price movements and ignore short-term price fluctuations. Friedman's hypothesis is that cash balances are held and are expected to be held over considerable periods of time and therefore short-run price fluctuations will not be relevant.

According to Friedman the level of consumption of an individual determines his demand for money for transactions purposes.

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67. Friedman, M. The Demand for Money: Some Theoretical and Empirical Results (in J. Pol. Econ. Vol. 67: 327-357, 1959).

68. The Demand for Money, p. 221.

69. The Demand for Money, pp. 21-22.

The individual's consumption is based not on his measured income but on his permanent income. Hence the individual's transactions demand will vary with his permanent income not his measured income. Thus we would expect permanent income and the demand for money to move directly. Desired money holdings will tend also to move directly with price changes, because the size of real money holdings will vary with changes in the purchasing power of money. Friedman maintains that the relevant price level will be permanent rather than measured prices. The individual is not likely to continually revise his estimate of the purchasing power of his money holdings in the light of short-term changes in the price level, but is more likely to do so with respect to long-term changes.

The function fitted by Friedman may be written as:

$$M = Y_p \cdot a \left( \frac{Y_p}{NP_p} \right)^b$$

where  $M$  is desired money holdings

$Y_p$  is permanent income

$N$  is population

$P_p$  is permanent prices

This may be expressed as

$$\frac{1}{M} = \frac{1}{Y_p} \cdot \frac{1}{a} \left( \frac{Y_p}{NP_p} \right)^{1-b}$$

$$\text{or} \quad \frac{Y}{M} = V = \frac{Y}{Y_p} \cdot \frac{1}{a} \left( \frac{Y_p}{N} \right)^{1-b}$$

where  $Y$  is measured income

$Y_p$  is permanent real income.

For empirical purposes people's expectations about future income streams may be best represented by a moving average of annual incomes taken over the period of the business cycle, so that all fluctuations in current income are taken into account. The assumption here is that people's expectations with regard to income are realised.

"The income figure we used ... is an average value over a cycle, which may be regarded as a closer approximation to permanent income than an annual value."<sup>70</sup>

A weighted average of past incomes is used, adjusted for secular growth, the weights declining exponentially. A similar approach is adopted to estimating permanent prices. The function fitted by Friedman is a linear function when expressed in terms of logs. When fitted the function yielded a value of 1.8 for 'b', so that measured income velocity varies inversely with permanent aggregate income in real terms. Thus we can say generally that the demand for money varies directly with permanent real income.<sup>71</sup>

One of the objects of the analysis is to shed some light on differences in secular and cyclical movements of the demand for money. Friedman holds that the rate of interest will not explain the changes in the demand for money which are not explained by changes in measured income. Secular changes in the stock of money are highly correlated with secular changes in income. However, although the stock of money also conforms to cyclical movements of income, the corresponding income movements are of a much greater

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70. The Demand for Money, p. 333.

71. pp. 107-111 above.

amplitude. This difference between the cyclical and secular relationships is not explained, according to Friedman, by the rate of interest. As an alternative to the rate of interest, Friedman provides the notion of permanent income as an explanation. The period of time relevant to the individual's permanent income is that of the business cycle. At cyclical peaks the individual's current income is higher than his expected future income stream and hence consumption will tend to take a lower proportion of current income than will be the case at cyclical troughs. As his income exceeds permanent income his consumption does not increase correspondingly; and similarly when current income falls below permanent income, consumption will not fall to the same degree. Permanent income is not necessarily stable over time, but will tend to rise less in expansions and fall less in contractions of economic activity. Further reinforcing this hypothesis is the influence of permanent prices. The permanent level of prices will probably fluctuate to some extent, as with permanent income, so that permanent prices will tend to rise at cyclical peaks and fall at cyclical troughs, but not to the same extent as measured prices. If permanent prices do not fluctuate as much as measured prices, since they in part determine the demand for nominal cash balances, then the demand for nominal cash balances will fluctuate less than it would if measured prices were the basis for determining the demand for money in nominal terms. Consequently it seems likely that the notion of permanent prices will provide support for the concept of permanent income in explaining the relatively small variations in nominal money holdings corresponding to cyclical variations

in current money incomes. The hypothesis that permanent real income would eliminate the secular and cyclical differences outlined were supported by the results of the empirical investigation. When the computed series on velocity and the observed velocity series were plotted, similar patterns in the two curves were revealed, both in long-run movements and cyclical movements. Much of the difference observed by Friedman between computed velocity using current income and observed velocity series is apparently eliminated by the use of permanent income and permanent prices in estimating the velocity.

Friedman notes in the course of his analysis that the measured income velocity of total money holdings shows a consistent decline over the period 1870 to 1958. He attributes this secular decline to two possible factors:

(1) that the services of money are regarded as a luxury, and so money holdings will expand more than proportionately with permanent income. For the same period 1870 to 1958 a secular rise in permanent income per capita is observed. Thus the supposition is plausible.

(2) that holdings of money are related primarily to non-human wealth,<sup>72</sup> and as non-human wealth in general expands more rapidly than permanent income (increases in income over time are the result more of improvements in technology and increases in the stock of capital per capita than of increases in the skill of the work-force or the average hours worked), then money holdings will

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72. This point corresponds very closely to the asset-demand examined on pp. 141-160 above.

also rise more rapidly than permanent income.

Since Friedman indicates that permanent income can be regarded as an index of total wealth both these points are closely related. In fact Friedman concludes "... the most fruitful approach is to regard money as one of a sequence of assets, on a par with bonds, equities, houses, durable consumer goods, and the like."<sup>73</sup> Thus Friedman's concept of permanent income in relation to the demand for money is essentially very similar to the demand for money based upon variations in total assets.

The permanent income hypothesis does much to improve estimates of income velocity, but Friedman concedes that other variables may also be important. Two possibilities mentioned are the rate of change of prices (as a measure of expectations) and the rate of interest. Both of these are examined. Charts were plotted comparing both these variables with the ratio of observed to computed income velocity.<sup>74</sup> The results upon inspection showed similar patterns for both variables in association with the ratio of observed to computed income velocity, and indicated that both interest rates and the rate of change of prices could explain some of the variations in velocity not explained by changes in permanent income

73. The Demand for Money, p. 349.

74. The ratio of observed to computed income velocity ( $\frac{Y}{Y_c}$ ) is probably used because Friedman's computed series on income is expressed in logarithms. Thus he would take the residuals in terms of logarithms -  $(\log Y - \log Y_c)$  - which when expressed in ordinary terms is  $\frac{Y}{Y_c}$ .

and permanent prices, particularly in the expansionary phase of the business cycle.<sup>75</sup> However, Friedman's conclusion on the importance of the interest rate variable is to emphasise that the movements in velocity not accounted for by the permanent income variable "... though characterised by a consistent cyclical pattern and though, on the basis of our tentative explorations, it may well be accounted for by movements in interest rates, is much too small to reflect any very sensitive adjustment of cash balances to interest rates."<sup>76</sup> On the rate of change of prices Friedman finds that this variable shows a close correspondence with the residuals in some phases of the cycles but not in others. He concludes that this variable is probably only significant when the rate of change of prices is greater than is the case for the majority of the years in the period which he examines.

## II Sectoral Analyses

So far in this chapter we have been concerned with analyses operating at the level of the economy as a whole. We now look briefly at a number of sectoral analyses to see if similar techniques and theories applied to particular sectors meet with the same success and yield the same sort of results as in aggregate analyses. The first two analyses examined use only the interest rate as the independent variable. These are a survey by Behrman<sup>77</sup> using the

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75. The analysis by Khusro examined on pp. 141-144 above uses the same technique of examining the residuals in seeking other explanatory variables.

76. The Demand for Money, p. 349.

77. Behrman, J. N. The short-term Interest Rate and the Velocity of Circulation (in *Econometrica*. Vol. 16: 185-190 and 370, 1948).

transactions velocity of circulation of cash balances as the dependent variable, and a survey by Bronfenbrenner and Mayer<sup>78</sup> who concentrate upon desired idle balances as the dependent variable. The other two analyses consider other explanatory variables than the rate of interest. These two analyses are those by Kisselgoff<sup>79</sup> and Brown<sup>80</sup> both of whom use desired money holdings as the dependent variable.

#### (1) Interest rates

A short survey by Behrman examines the connection between the velocity of circulation of cash balances and the short-term rate of interest for a sample of large manufacturing concerns in the U.S. Cash balances were taken as total bank balances adjusted for time deposits for the sample of manufacturing corporations. These were calculated as annual averages. Cash balances were taken as total bank balances adjusted for time deposits for the manufacturing corporations chosen. These were calculated as annual averages. The transactions velocity of circulation was then calculated for the years 1919-40 by dividing annual cash payments by average cash balances. The short-term interest rate used is the rate of interest on four to six months commercial paper. When the velocity of circulation series was plotted against the interest rate series,

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78. Bronfenbrenner, M. and T. Mayer. Liquidity Functions in the American Economy (in Econometrica. Vol. 28: 810-834, 1960).
79. Kisselgoff, A. Liquidity Preference of Large Manufacturing Corporations, 1921-1939 (in Econometrica. Vol. 13: 334-344, 1945).
80. Brown, A. J. The Liquidity Preference Schedules of the London Clearing Banks (in Ox. Econ. Papers. No. 1: 49-82, 1928).



Behrman found that a free-hand curve drawn through the points and appearing to provide a reasonable fit took the form of a "J" curve with the elasticity of the velocity of circulation highest at low levels of the rate of interest. The years 1921 and 1931 to 1933 are well off the curve. Behrman attributed this fact to the financial crises occurring in these periods but concluded that apart from such unusual circumstances, the short-term rate appears to be the most important explanatory variable of the velocity of circulation, its influence only being superseded by that of other variables in unusual circumstances.

The examination does not extend to a precise calculation of elasticities and other properties of the relationship, and without this sort of information, it is difficult to say more than that the relationship between interest-rates and velocity, as applied to large manufacturing concerns in the U.S., appears to take the Keynesian form with increasing interest-elasticity of the velocity of circulation of money as the rate of interest falls. Also it appears that Keynes' notion of an inelastic velocity at high interest rates, and a highly elastic velocity at low interest rates is supported, although such a conclusion is based merely upon inspection of the curve and cannot be stated with complete conviction.

We have seen earlier in this chapter the examination by Bronfenbrenner and Mayer of short-run demand-for-money functions and aggregate demand functions. Their article<sup>81</sup> also examines the

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81. Liquidity Functions in the American Economy.

possibility of sectoral demand-for-money functions. The disaggregation for the sectoral analysis is:

(a) corporations

and (b) individuals and unincorporated businesses, treated first together and then separately.

In all cases it is only the simple idle balances - interest rate relationship which is examined with all figures in money terms deflated using the consumer price index. Idle balances are estimated by the maximum sample velocity method. The series used for idle balances is derived from currency plus demand deposits and time deposits in the case of all sectors. A further examination considers the corporations sector and the individuals and unincorporated businesses sector in terms of idle balances excluding time deposits. As well as using idle balances as the dependent variable, the Cambridge  $k$  is also used. The income figures used both in estimating idle balances and in the Cambridge  $k$  varied between the sectors. The income used for the corporations sector was gross income. Thus transactions velocity is the dependent variable for the corporations sector. For all other sectors it is income velocity where the income figure used is represented for unincorporated businesses by the total assets of this sector, and for both individuals and unincorporated businesses the income figures are expressed in money terms; they are not deflated. The independent variable in all the relationships is the short-term interest rate, represented by the four-to-six months commercial paper rate. In the case of some sectors six months and

one year time lags in income were used and also monthly rates averaged over the previous twelve months were used in addition to current interest rates. Where time deposits were included in money holdings the rate of interest was adjusted for the rate of return on time deposits.

The usefulness of the functions fitted was tested by using them to make predictions. The functions provided good predictions of the direction of changes in money holdings, but appeared to be of doubtful value in predicting the size of these movements. Also it was noted that the disaggregation by sectors appeared to do little in improving the predictive power of the function as the aggregate function relating idle balances and the rate of interest provided as good or better predictions as any of the functions for the other sectors.

As suggested by Keynesian theory,<sup>82</sup> consistent inverse relationships between idle balances and interest rates were revealed in all the functions fitted. Also the interest-elasticity of both desired idle balances and the desired Cambridge  $k$  were calculated for all sectors and proved to be higher for idle balances than for the Cambridge  $k$ . This is to be expected since, given the level of income, a particular change in desired idle balances induced by some change in the rate of interest will have a smaller proportionate effect upon desired money holdings and therefore upon desired

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82. See chapter two above.

Cambridge k than it will have upon desired idle balances. Thus given the level of income and the change in the rate of interest the change in desired idle balances should be proportionately larger than the change in desired Cambridge k. Bronfenbrenner and Mayer do not test the "liquidity trap" hypothesis or the other extreme of an interest-inelastic velocity of circulation in their sectoral analysis, so the only conclusion to be drawn about the idle balances - interest rate relationship is that it appears to be an inverse one. Perhaps the most significant result of the analysis is that the apparent responsiveness of money holdings to interest rate changes is not merely a characteristic of financial institutions, but is a feature common at least to all the sectors examined.

(ii) Interest rates and rates of profits

The study by A. Kisselgoff<sup>83</sup> incorporates the rate of profit of corporations in a function of the demand for money. The purpose of his analysis is to attempt to find an explanation of the changes in the cash balances of large manufacturing corporations in the U.S. for the inter-war period (1921-39). The cash balances of corporations are the total year-end figures for the forty five corporations in the sample taken from their financial statements. Total cash balances are taken to consist of transactions money and "free" money, where free money is the excess of cash held over transactions money (idle balances). Desired total balances is the dependent variable.

As explanatory variables, Kisselgoff uses:

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83. Liquidity Preference of Large Manufacturing Corporations, 1921-1939.

(1) Annual payments of corporations ( $P$ ) as an indicator of the transactions needs of businesses.

(2) the rate of interest ( $i$ ) as represented by the yield on U.S. bonds  $3\frac{1}{2}$  years from maturity.

(3) the rate of profit ( $R$ ) as an indicator of expected profits. Presumably as the rate of profit expected increases (the greater are receipts relative to payments) the smaller will be the demand for free money by the corporations concerned. This variable is represented by the ratio of net income to net worth of the corporations.

Both the rate of interest and the rate of profit relate to the demand for "free" money. Also tested as possible explanatory variables were: the rate of change of the price level and financial expectations, as measured by year-to-year changes in annual interest rates. However, when tested neither of these variables appeared important enough to warrant inclusion in the function to be fitted. The function fitted is:

$$C_t = a + bP_t - ci_t - dR_{t-\frac{1}{2}}$$

where  $C_t$  is total cash balances in the year  $t$

and  $P_t$ ,  $i_t$  and  $R_{t-\frac{1}{2}}$  are as defined with the rate of profit lagged six months.

The results proved unsatisfactory as the estimates of free money, estimated by the regression method,<sup>84</sup> were negative for many years.

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<sup>84</sup>. See this chapter, pp. 97-101 above.

In the light of these unsatisfactory results Kisselgoff makes a fresh start with free money or idle balances as the dependent variable. The estimates of free money are obtained using the alternative method, the maximum sample velocity method. The estimate resulted in a velocity of sixteen. The estimates of free money obtained in this way were first used in a linear regression relating free money to the rate of interest and the rate of profit lagged six months and the results showed an inverse relationship between free money and both explanatory variables. Thus the higher the rate of interest and the expected rate of profit, the less will be the demand for free money. Correlations between both pairs of variables were highly significant. The elasticity of free money to both explanatory variables was calculated at the point of averages. These elasticities prove to be significant, particularly in the case of the rate of interest. The point-elasticity of free money holdings to the rate of interest is 1.26, and with respect to the rate of profit the point-elasticity is 0.9%. An index of the purchasing power of the dollar and interest rate changes (as a measure of financial expectations) were then tried as additional explanatory variables. As expected the purchasing power of the dollar revealed a positive relationship with free money holdings. Thus as prices fall desired free money holdings rise. However the relationship did not prove to be statistically significant. Similarly the variable interest rate changes yielded results which were not statistically significant.

The regression found to provide the closest estimates of

idle balances, and eliminating any independent variables of doubtful statistical significance was the relationship between free money, the rate of interest and the rate of profit. The interesting feature of this analysis is that the rate of interest is the most important explanatory variable of the demand for money, although the rate of profit is also highly significant. Thus the relationship between idle balances and interest rates postulated for the whole private sector appears to have some validity when applied only to a sample of manufacturing concerns.

(iii) Assets and interest rates

The final study to be examined is that by A. J. Brown.<sup>85</sup> As with the analysis by Khusro examined earlier,<sup>86</sup> Brown postulates a relationship between money holdings, interest rates and assets. However, Brown's analysis relates not to the whole economy, but to the London clearing banks. He adopts the approach that the liquidity position of an individual may be represented by the ratio of his more liquid to his less liquid asset holdings for any given values of the yields of the different assets, if constant liquidity of the assets involved is assumed. In other words, an asset ratio is taken as an index of liquidity.

An increase in the ratio indicates an increase in the liquidity preference of the banks. Of course, if the relative liquidities of the two asset types alter, as for example if the less

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85. The Liquidity-Preference Schedules of the London Clearing Banks.

86. See pp. 141-144 above.

liquid assets become even less liquid it is likely that the banks will increase their demand for the more liquid assets in order to restore their liquidity position. The result will be an increase in the assets ratio not because the banks' liquidity preference has changed, but because the relative liquidities of the two asset types has changed.

Brown argues that the ratio of desired holdings of the two asset types will vary with:

(a) the relative prices of the two groups of assets used.

If the yield on the less liquid assets increases relative to the yield on the more liquid assets, the quantity of less liquid assets demanded will increase and the ratio of more liquid to less liquid assets will fall. Therefore the ratio of the more liquid to the less liquid assets will move in the same direction as the ratio of their yields and so in the opposite direction to the ratio of their prices which is the variable used by Brown. The relationship anticipated between the asset and price ratio is then an inverse one.

(b) the product of the two asset types. This variable is supposed to represent total assets, and therefore its inclusion is directly parallel to the inclusion of total assets as seen in some of the aggregate analyses of the demand for money. Brown terms this variable the "resources variable".

The relationship between these three variables - the asset ratio, the yield variable and the resources variable - is Brown's liquidity preference schedule for an individual for the two asset



types concerned. For his actual empirical analysis, Brown chooses the London clearing banks because their motivations in business and their business practices are similar. The five main asset types held by these banks may be divided into two groups:

(1) investments and advances;

(2) cash, loans at call and short notice, and bills discounted.

Over the period examined (1925-34) the first group forms about two thirds of total deposits, and the second group about one third, with virtually no variation in these proportions. Therefore, Brown concludes the two groups can be regarded separately. In the second group, cash and short loans are combined on the ground that cash and short loans have a high negative correlation with bills, and thereby the number of items in the second group is reduced to two.

The liquidity preference schedules for the two groups of assets are respectively:

$$\log \left( \frac{C}{B} \right) = a_1 + b_1 \log P_{CB} + c_1 \log CB \dots \dots \dots (28)$$

(asset ratio) (yield variable) (resources variable)

$$\log \left( \frac{I}{A} \right) = a_2 + b_2 \log P_{IA} + c_2 \log IA \dots \dots \dots (29)$$

where C is cash plus short loans,

B is bills discounted,

$P_{CB}$  is the price ratio of cash and bills,

I is investments,

A is advances,

and  $P_{IA}$  is the price ratio of investments and advances.

When fitted, the schedules yield high multiple correlation coefficients. In both cases, the prices variable is negatively correlated with the assets ratio, but the resources ratio is negatively correlated in the first case and positively in the second. Thus, in the investment-advances schedule, the ratio of the more liquid to the less liquid asset increases with increases in the total resources available. This result is explained by the need to increase both investments and advances, as cash balances expand beyond the required level, and by the fact that investments can be increased more readily than advances. On the other hand, the decline of the cash-bills ratio associated with an increase in total resources is attributed to the smaller relative cash holdings required to provide the same desired degree of safety when total deposits are higher.

An examination of movements over the period covered suggested that the behaviour of the banks, with respect to investments and advances, might be extended to an examination of shorter periods. Brown suggests that separate and distinct schedules could be derived for sub-periods. The regression (29) has been fitted and the series for  $\log \left( \frac{I}{A} \right) - b_2 \log P_{IA}$  and  $c_2 \log IA$  are plotted against each other with  $c_2 \log IA$  on the horizontal axis. An inspection of these points leads Brown to the subdivision of the period 1921 to 1936 into four shorter periods. He fits regressions of the same form as (29) for each of these periods. These estimates together with an examination of the nature of each of the sub-periods leads Brown to

the conclusion that the schedule for the desired investments-advances ratio will assume three distinct forms. These relationships and the conditions to which they relate follow "... something like the following series of relations in the various phases of the trade cycle:"<sup>87</sup>

in depression and recovery:

$$\log \frac{I}{A} = -10.0 - 0.7 \log P_{IA} + 1.7 \log IA \quad \dots \quad (30)$$

in boom:

$$\log \frac{I}{A} = -1.3 - 0.1 \log P_{IA} + 0.1 \log IA \quad \dots \quad (31)$$

in slump:

$$\log \frac{I}{A} = -10.0 - 0.2 \log P_{IA} + 1.7 \log IA \quad \dots \quad (32)$$

The parameters are elasticities since these are logarithmic relationships. It is clear that the desired assets ratio is elastic to changes in the prices variable and particularly the resources variable. In time of boom economic conditions it is apparent from the elasticities which are both of the same magnitude (0.1) that the desired assets ratio is insensitive to both the explanatory variables used. In slump conditions the relationship (32) indicates that the desired assets ratio is elastic only to the resources variable.

Thus Brown concludes that "... the asset-variable is sensitive to

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87. The Liquidity-Preference Schedules of the London Clearing Banks, p. 82.

changes in both yields and resources in depression and recovery ...., relatively insensitive to both ... in boom, and sensitive only to changes in resources in slump."<sup>88</sup> It would appear then, that there are variables, other than those discussed by Brown, which are relevant, particularly in times of boom and slump. It is significant that the variables used have their greatest influence when the economy is moving between its two extreme positions, as it is to be expected that in the abnormal conditions existing at these extremities other variables than those of prime importance in normal circumstances should become apparent.

### C. Conclusion

The following is not intended in any way to be an exhaustive discussion of the analyses considered in this chapter but is designed to present briefly and in general terms what appear to be the most important features of these analyses and to see what general conclusions may be reached from them.

In the analyses which investigated the simple Keynesian function relating money holdings to income and interest rates, interesting results were found. Where only graphs were drawn, an inverse relationship between interest rates and desired idle balances was apparent, and where regressions were fitted this inverse relationship received further support.

Some of the investigations testing other variables found

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88. The Liquidity-Preference Schedules of the London Clearing Banks, p. 74.

the rate of interest to be a secondary factor, and some even found the rate of interest to be of no real significance in explaining desired total money holdings. The majority however supported the findings of the analyses which investigated the simple demand-for-money function relating desired idle balances and the rate of interest. In many of the analyses a short-term interest rate was used as an explanatory variable of the demand for money. Selden<sup>89</sup> found that the rate of interest on money substitutes was highly significant. On the other hand he found that the rate of interest on money complements (the long-term rate of interest) was positively related to the quantity of money with one of the two rates used and that the results were not statistically significant for either rate. Friedman<sup>90</sup> and Lydall<sup>91</sup> found the interest rate to be of little importance. Bronfenbrenner and Mayer<sup>92</sup> in their aggregate analysis and Kisselgoff<sup>93</sup> in his sectoral analysis were amongst those who found the rate of interest to be the most important explanatory variable examined.

The rate of change of prices was investigated by Bronfenbrenner and Mayer and by Friedman and in both cases was

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89. Monetary Velocity in the United States. pp. 129-135 above.

90. The Demand for Money: some Theoretical and Empirical Results. pp. 161-167 above.

91. Income, Assets, and the Demand for Money. pp. 157-160 above.

92. Liquidity Functions in the American Economy. pp. 145-150 above.

93. Liquidity Preference of Large Manufacturing Corporations. pp. 172-175 above.

rejected - on the basis of statistical results by the former and inspection by the latter. Brown<sup>94</sup> in his aggregate study found the rate of change of prices to be of almost equal importance with the rate of interest as an explanatory variable in the demand-for-money function. However, his was the only analysis yielding this result.

The change in the rate of interest over the previous year was considered by both Brown in his aggregate analysis and Kisselgoff in his sectoral analysis as a measure of expectations about the rate of interest. In both cases the variable was not found to be statistically significant.

Total assets was another variable considered in a number of studies and the results were more consistent and significant than for any variable than perhaps income. Whether Friedman's permanent income or some estimate of total wealth or assets was used, the asset variable yielded positive correlations with money holdings in all analyses except in one of the two regressions fitted in Bronfenbrenner and Mayer's analysis and in one of the two regressions fitted in Brown's investigation of the London Clearing banks.<sup>95</sup> Turvey<sup>96</sup> examines quantities of several types of assets as independent variables in his function. His results indicate a significant relationship between the quantity of money, the

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94. Interest, Prices, and the Demand Schedule for Idle Money.  
pp. 135-139 above.

95. The Liquidity-Preference Schedules of the London Clearing Banks.  
pp. 175-180 above.

96. Interest Rates and Asset Prices. pp. 151-157 above.

quantities of other asset types and interest rates. In the case of the study by Bronfenbrenner and Mayer the variable total assets was not significant for either regression but in all other cases a significant result emerged. The asset variable yielded a high correlation with money holdings in the other analyses testing it. Lydall<sup>97</sup> in particular relied solely upon total assets to explain the demand for idle balances.

Finally, the level of income and the volume of transactions were both generally closely correlated with desired money holdings, the only notable exception being in Lydall's study in which the income variable yielded a negative, though not significant, correlation with money holdings.

The analyses considered together clearly do not present a single, consistent result. There is no complete agreement either in the approaches adopted to the demand function for money or in the results obtained. However, there are certain points on which general agreement is reached, though always with a few exceptions. Certainly the closer correlations resulting from the inclusion of additional variables in the demand-for-money function indicates that something more than the relationship between money holdings, income and interest rates is required. In most cases the results indicate that the inclusion of total assets or wealth is justified. The results also strongly support the inclusion of the level of income. For the rate of interest the position is not as clear-cut

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97. Income, Assets, and the Demand for Money. pp. 157-160 above.

nor is its role in explaining the demand for money as important as might have been expected. However, the relationship between money holdings and the rate of interest, though in a number of cases not statistically significant, is consistent in its support of the inverse relationship suggested by Keynesian theory<sup>98</sup> and often a highly significant result is obtained.

Both long-term and short-term interest rates have been tested empirically and generally significant results indicating an inverse relationship between desired idle balances and both rates of interest have emerged. Results pertaining to the rate of change of prices are not as encouraging but this variable has not been examined as closely or extensively as the other variables and as it provided significant results in one analysis, further investigation is probably justifiable. The change in the rate of interest over the previous year has also received only limited attention. However, in both cases in which it was considered it was rejected. In any case the justification for its inclusion is less convincing on a priori grounds than for the other variables, since its supposed role in the field of expectations may well be played by the rate of interest itself. The use of time lags for many variables instead of current figures was frequently tested, but generally better results were obtained using the current figures, and where time lags did provide better results, the difference was in most cases not marked.

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98. See chapter two above.



It may be concluded from the above summary that, although some of the results of the analyses examined are not statistically significant, the results were generally in accord with a priori conclusions.<sup>99</sup> Some of the regressions fitted in fact yielded high multiple correlations, providing potentially useful schedules of the demand for money. Thus, in spite of the fact that investigations to date have not been as successful as may have been anticipated or desired, results on the whole are sufficiently interesting to warrant further investigation of the demand for money along the lines so far pursued.

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99. See chapters two and three above.

## CHAPTER FIVE

### A DEMAND-FOR-MONEY FUNCTION FOR AUSTRALIA

Empirical investigations into the demand for money such as those discussed in chapter four are subject to a number of important limitations, even if the function fitted is of the most suitable form and even if all the more important explanatory variables are included. The analyses considered in chapter four contain no proper discussion of these limitations. It is important that these sources of error be recognized and it seems desirable that they be considered in this analysis. The analyses considered in the previous chapter did not consider these weaknesses and in fact there is little to suggest that the authors of these studies were aware of them. For this reason it seems desirable to begin this chapter by presenting a systematic discussion of the limitations in question. We shall undertake this in the next section. We shall then proceed to develop an empirical demand-for-money function for Australia using ideas which have formed the basis of similar work done in other countries. This will of course be subject to all the limitations that we have been discussing.

#### A. Limitations of Empirical Analyses of the Demand for Money

Empirical investigations of the demand for money are subject to three main limitations. The first arises from the need

to identify the demand for money with the stock of money wherever the demand for money is used as the dependent variable.<sup>1</sup> Only the stock of money can be observed and therefore in an empirical analysis we must assume that the demand for money and the stock of money are identical. The second arises from the use of the least squares estimation procedure. There are a number of difficulties which arise out of this technique and crop up wherever it is used.<sup>2</sup> The third arises from the so-called identification problem. We shall deal with each of these in turn.

#### I. The problem of observing the demand for money

The only way in which the demand for money can be observed is to regard it as identical with the stock of money. The demand-for-money function is obtained by observing actual money holdings together with the explanatory variables. The implication is that the stock of money and demand for money are in equilibrium so that desired and actual money holdings are the same. If the stock of money is in excess of the quantity demanded, given the values of the explanatory variables, the observed figures will yield a position which is not a point on the demand curve. For instance if the only explanatory variable included in the demand-for-money function is the rate of interest, then given the stock of money this stock and the demand for money will not be equal unless the

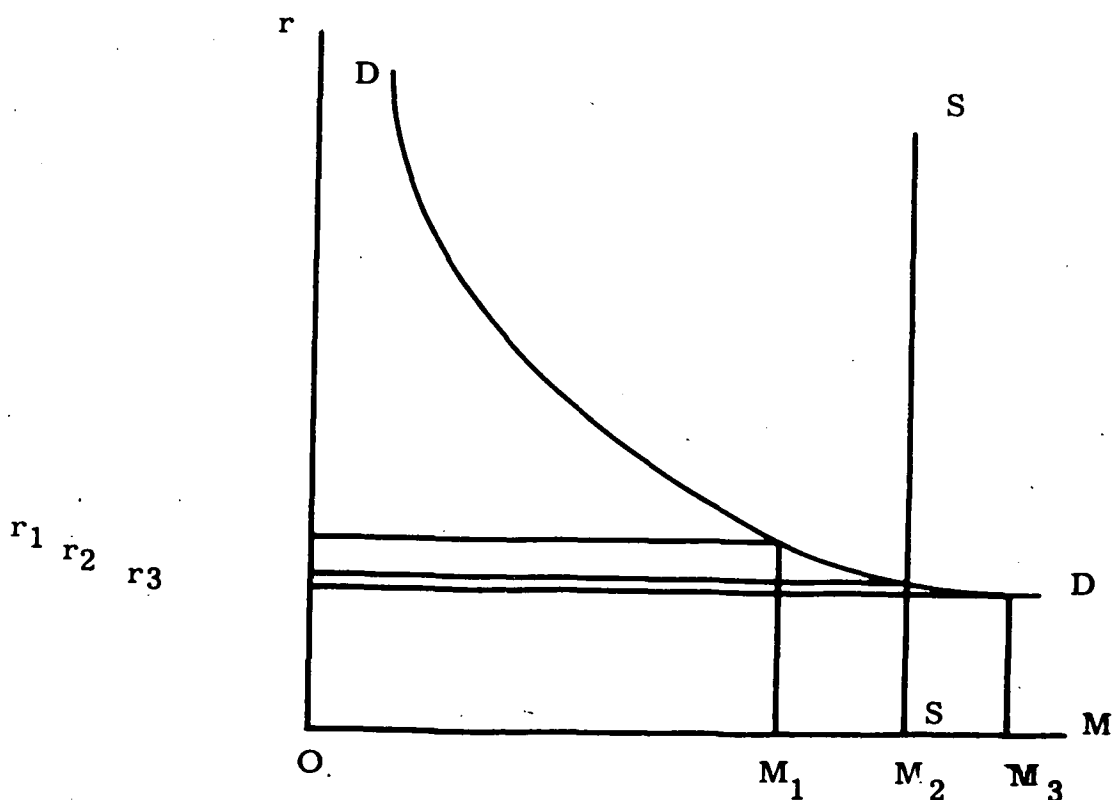
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1. It will be recalled that some of the analyses examined in the previous chapter used the rate of interest as the dependent variable.

2. There are other more elaborate alternatives to least squares estimation but it seems to have been the only one used in the analyses examined in chapter four.

rate of interest assumes a particular value ( $r_2$  in figure 6). In this figure DD is the demand schedule and SS the stock of money. The quantity of money is measured along the horizontal axis and the rate of interest along the vertical axis. At  $r_3$  desired money holdings will be in excess of actual holdings, and at  $r_1$  actual money holdings will be in excess of desired money holdings. Thus, with the stock of money and the demand schedule as specified in figure 6, the only position of equilibrium is where the rate of interest is  $r_2$  and the quantity of money  $M_2$ .

Figure 6



In an empirical analysis it is the point of intersection of the demand schedule DD and the stock of money SS in this example which we assume we are observing at any point of time. We have no alternative than to assume that this is in fact so, but some attempt should be made to see to what extent this assumption is justifiable, particularly as it is a question which has been largely ignored by other analyses of the demand for money.

Perhaps the best way of throwing some light on the issues involved in this question is to quote a passage from a recent article by Phillips.<sup>3</sup> "... it seems desirable to illustrate some general points about equilibrium, stability and fluctuations in the simplest possible way. Let me therefore consider a single commodity which is being continuously produced and consumed and which is traded on a perfectly competitive market. Assume that the rate of production is an increasing function of price, the rate of consumption is a decreasing function of price and that the rate of change of the price is proportional to the excess demand, i.e. to the rate of consumption minus the rate of production. This is the simple text-book example of supply and demand in a single competitive market. It is frequently stated, and has indeed been stated with some emphasis by such eminent economists as Walras, Marshall and Wicksell, that such a system is necessarily stable, i.e., that it always tends to an equilibrium in which the price is such that the rates of production and consumption are equal. The

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3. Phillips, A. W. Employment, Inflation and Growth (in Economica. Vol. 29, No. 113: 1-17, 1962) pp. 3-4.

argument is usually very simple. Suppose the system is not in equilibrium; for example, suppose there is excess demand. Then the price will rise. This will increase production and reduce consumption and so reduce the excess demand. Since the price continues to rise so long as there is any excess demand, and any rise in price reduces the excess demand the process will continue until the excess demand is eliminated. In brief; the existence of any discrepancy between production and consumption causes a movement in price which tends to correct the discrepancy.

Therefore, the argument runs, the system is stable. This argument is, of course, fallacious except on the assumption that the complete response of the rates of production and consumption to any change in price occurs instantaneously. If there are any time lags in any of the responses the system will usually fluctuate. Whether the fluctuations will die away or whether they will increase in amplitude and tend to some regular and sustained limit cycle depends on the precise forms of the time lags, on the slopes of the supply and demand curves and on the speed at which the price changes when there is a given excess demand."

Two points emerge from this passage:

1. If there are no time lags the assumption that actual and desired money holdings are identical will hold so long as an excess demand for money so influences the explanatory variables that the excess demand is reduced. Is this in fact likely to happen? We can get some idea by looking at the

effects of an excess stock of money on each of the explanatory variables considered in the previous chapters. These are: liquid assets, total assets and the level of income all measured in terms of money, the rate of interest and the rate of change of prices. What we want to find out is whether an excess stock of money induces changes in the explanatory variables such that the demand for money alters to equate the stock of money and the demand for money. Given the volume of liquid assets and total assets an excess stock of money will cause individuals and firms to attempt to reduce their holdings of money and other liquid assets and to increase their holdings of non-liquid assets. As a result the prices of non-liquid assets will rise. Also as asset prices rise interest rates will necessarily fall and given the stock of assets and the prices of liquid assets the value of total assets will rise. As a result of the reduced demand for liquid assets short-term interest rates will tend to rise. The associated fall in the prices of liquid assets, given the stock of liquid assets, will tend to offset the influence on the value of total assets of the increase in prices of non-liquid assets. The fall in long-term interest rates may lead to an increase in investment in which case the level of money income will rise. All these movements - increases in the value of total assets and the level of money income and falls in the long-term rate of interest and the value of liquid assets - are consistent with an increase

in the demand for money.<sup>4</sup> Thus all these factors will tend to restore the equality of the demand for money and the stock of money whenever a disparity appears between the two. However we still have to consider the rate of change of prices. If the rise in income and investment associated with an excess stock of money leads to a rise in commodity prices (as it may well do under full employment conditions) then this rise may represent an increase in the rate of increase of prices. For this to happen the rate at which prices rise must be faster than the rate at which they were rising previously. Since this event is quite possible we must conclude that an excess demand for money may lead to increases in prices which will be such that the demand for money falls thereby exaggerating the excess stock of money. To sum up, it would appear that the rate of change of commodity prices is the only one of the explanatory variables considered which will alter in response to an excess stock of money in such a way that the excess stock grows. Even then the rate of increase of prices will have such an effect only if the induced rise in the price level is sufficient to bring about an increase in the rate of increase. Furthermore the system will be stable if the induced changes in the explanatory variables other than the rate of change of prices have a greater influence on the demand for money than the induced

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4. The probable relationship of the explanatory variables with the demand for money is discussed in chapters two and three above.



change in the rate of change of commodity prices.

2. So far we have discussed the question of stability under the assumption that there are no time lags in the adjustment of the explanatory variables to an excess stock of money, or in the adjustment of the demand for money to changes in the explanatory variables. In fact however there almost certainly are such lags. While interest rates, the value of total assets and the value of liquid assets may conceivably adjust quite quickly to an excess stock of money, the likelihood is that there will be imperfections in the asset market which will result in time lags in the adjustment of asset prices to an excess money stock. In any case there will be time lags in the adjustment of the level of money income and the rate of change of commodity prices. The level of money income increases due to an increase in investment in response to a fall in the interest rate. We can realistically assume that the interest rate will change immediately in response to an excess stock of money. However, it would not be realistic to say that the rate of investment will increase immediately. Entrepreneurs may make the decision to invest immediately the rate of interest falls, but there must be a time lag between the time the decision is made and the time the plans are completed and the project undertaken. There will then be a further time lag before the full impact of the increase in the rate of investment makes itself felt upon the level of money income. In time of full employment the influence of an increase in the demand for goods and services will

tend to be reflected in an increase in prices rather than an increase in output than will be the case when there is excess productive capacity in the economy. To the extent that price changes do take place in response to an excess stock of money, they will be subject to the same time lags as changes in the level of money income since the same factors influence both these variables. Even when the rate of investment does change the price level may not react immediately. Imperfections in the markets for investment and consumer goods, methods of pricing adopted by the producers and the existence of stocks of goods will probably add to the time lag in the adjustment of the price level.

It seems probable then, that the explanatory variables will change in such a way in response to an excess stock of money that the excess will tend to be eliminated. Considering this point alone the assumption that the demand for money and the stock of money are one and the same thing is justifiable although there may be a qualification resulting from the influence of the rate of change of prices. However, the assumption loses its validity when the possibility of time lags is introduced. The existence of time lags will have the effect of delaying the restoration of the equality of the demand for money and the stock of money. During this time interval the observed stock of money will not represent the desired stock. It is likely that the operation of time lags in a dynamic situation will result in a condition in which the money market is rarely in equilibrium. It can be seen therefore that

the assumption of equality between the desired and actual stock of money is a dubious proposition. It is a necessary assumption for an empirical analysis of the demand for money, but while using it we should be aware of its vulnerability and of the limitations which it imposes upon an analysis. We cannot be more specific about the influence of time lags. We need a complete economic model to say explicitly what the effect of time lags will be. The general point is that time lags do matter and destroy the validity of the assumption of the equality of desired and actual money holdings.

## II. Limitations of least squares estimation

Before we can discuss the limitations of this technique it will be necessary to clarify several basic statistical concepts.

In the first place we need to be clear about the concept of an estimator. Whenever a statistical measure is computed from a sample with a view to estimating some parent parameter then we describe the statistical measure in question as an estimator of the parameter. For example if we compute the mean of a sample with a view to estimating the parent mean we refer to the sample mean as an estimator of the parent mean. To take a second example consider the linear relationship:

$$Y = \alpha_0 + \alpha_1 Z_1 + \alpha_2 Z_2 + \dots + \alpha_n Z_n + U \quad \dots \quad (1)$$

where  $Y$  is the dependent variable,  $Z_1, Z_2, \dots, Z_n$  are explanatory variables and where  $u$  is the error term.

If we use least squares calculations based on sample data

to estimate the parent parameters  $\alpha_0, \alpha_1, \dots, \alpha_n$  in such a linear function then we say we are using the least squares estimator of the parent parameters.

The second point to be noted is that an estimator will be a random variable. Thus it is a variable whose character is indicated by a probability distribution and by the parameters of this distribution such as the mean and the variance of the distribution.

Thirdly we need to be clear about the generally accepted qualities of a good estimator. The most important of these are: unbiasedness, efficiency and consistency. These will be considered in turn.

An estimator is unbiased if its mean is equal to the parameter that it is being used to estimate. Using the function (1) above as an example the least squares estimator will be unbiased if the mean values of the estimates of the parameters  $\alpha_0, \alpha_1, \dots, \alpha_n$  are equal to the corresponding parent magnitudes.

An estimator is consistent if the following condition is satisfied:<sup>5</sup>

$$\lim_{n \rightarrow \infty} P(|f - \theta| > \epsilon) = 0$$

where  $P$  is the probability of the event  $|f - \theta| > \epsilon$ ,  $f$  is the estimator,  $\theta$  is the parent magnitude,  $\epsilon$  is some arbitrary

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5. Klein, L. R. A Textbook of Econometrics. 1953.  
See p. 52.

small positive figure and where  $n$  is the number of observations in the sample.

An efficient estimator is an estimator which, for any sample size has a variance smaller than that of any other unbiased estimator of the same population parameter. An efficient estimator thus has the property of minimum variance.

The above three properties are desirable characteristics of an estimator. It remains to be seen now under what conditions these properties will be possessed by the least squares estimator. Estimates of the parameters of a linear stochastic relationship which are unbiased, consistent and efficient will be produced by the least squares method of estimation if the following assumptions<sup>6</sup> are satisfied:

(a) The error term is normally distributed with zero mean and finite variance.

(b) The variance of the error term is constant over time. Thus the factors determining the error term remain the same in number, relative importance and <sup>a</sup>absolute influence.

(c) The error terms of different time periods are independent.

(d) The error term of any time period is independent of the explanatory variables of that or any other time period. The limitations of least squares estimation arise from the fact

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6. No attempt is made here to explain these assumptions. They are drawn from: Valavanis, S. Econometrics. 1959. See chap. 1, pp. 9-17.

that one or more of these assumptions is almost always violated. Thus it is highly probable that least squares estimates will not have the desirable qualities of unbiasedness, consistency and efficiency which follow if the assumptions are satisfied. A few examples will serve to illustrate the manner in which least squares estimation may fail to satisfy all the requirements.

As pointed out by Valavanis<sup>7</sup> the assumption that the error term is normally distributed relies on the proposition that the variables constituting the error term are infinite in number and not interlinked. This appears to be an improbable condition on both points. Take for instance the demand-for-money function in which the demand for money is explained in terms of interest rates and income, then tastes and assets will be among the variables which are taken care of by the error term. Now it seems quite probable that tastes and assets are related since people's tastes vary as their wealth position varies. In this manner the variables determining the error term may be linked, in which case the assumption that the error term is normally distributed is not likely to hold. As regards the assumption that the variance of the error term is constant over time, we must assume that there are no errors of measurement in the information used in an empirical analysis. If in fact there are such errors they will be one factor determining the error term. Since statistical collections tend to improve over time the

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7. Econometrics. p. 15.

variance of the error term will correspondingly tend to diminish and thereby invalidate the assumption of constant variance of the error term over time. The third assumption means that the factors influencing the error term in any period act independently of their behaviour in all other periods. One factor suggested by Valavanis<sup>8</sup> which makes this condition invalid in some circumstances is that the error term may include variables which act in a cyclical fashion. For instance, if consumption is increased every three years because that is the frequency with which new models appear, this effect should be introduced as a separate variable in the consumption function and should not be included in the error term since its inclusion would result in the error term acting in a cyclical fashion and the assumption of independence through time of the error term would be violated. The final assumption made was that the error term of any time period is independent of the explanatory variables of that or any other time period. Once again the example used by Valavanis<sup>9</sup> provides a good illustration of the way in which this assumption may be violated. Suppose that today's price ( $P_t$ ) is set by sellers on the basis of the change in the quantity sold yesterday over the quantity sold the day before. This may be expressed symbolically:

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8. Econometrics. p. 16.

9. Econometrics. pp. 16-17.

$$P_t = a + b(q_{t-1} - q_{t-2}) + u_t \quad \dots \quad (2)$$

If we suppose that the greater and the more evident the change in  $q$  the more the sellers strive to fix the price according to the above standard, then the assumption (d) is violated.<sup>10</sup> A further example of the way in which the assumption may be violated is used by Cochrane.<sup>11</sup> The model used is:

$$X_t^D = a P_t + u_t \quad \dots \quad (3)$$

$$X_t^S = b P_{t-1} + v_t \quad \dots \quad (4)$$

$$X_t^D = X_t^S \quad \dots \quad (5)$$

where  $X_t^D$  is the quantity of a good demanded in the year  $t$ ,  $X_t^S$  is the quantity of the good supplied in the year  $t$ ,  $P_t$  is the price of the good in the year  $t$ ,  $P_{t-1}$  is the price of the good in the year  $t-1$  and  $u_t$  and  $v_t$  are error terms.

From these expressions we get the relationship:

$$P_t = \frac{b}{a} P_{t-1} + \frac{1}{a} (v_t - u_t) \quad \dots \quad (6)$$

Thus the price of the good in the year  $t$  depends upon the previous year's price and the error terms. The price of the good is a function of the error term. Therefore, we cannot

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10. p. 197 above.

11. Cochrane, D. Measurement of Economic Relationships (in Econ. Rec. Vol. 25, No. 49: 7-23, 1949). See pp. 9-10.



justifiably assume that the error term of the demand function is statistically independent of the explanatory variable since the explanatory variable in the demand function is the price of the good in the year  $t$ . Many other similar examples could be shown. Where we have a full model (whether or not it is explicitly recognised or stated) the assumption will almost certainly be violated. In an analysis of a single function we are inclined to forget that it is a part of a wider system and because of this that it is unlikely that the assumption (d) will be valid.

So far we have considered two limitations of an empirical analysis of the demand for money. The first was centred on the assumption that desired and actual money holdings are identical. The second related to the use of least squares estimation. The third and last limitation to be considered here arises from the identification problem.

### III. The identification problem

The nature of the identification problem must first be explained. It is frequently possible to combine two or more equations of a model and emerge with an equation which is indistinguishable statistically from one of the equations of the model. When this happens we say that the equation concerned is not identifiable or it is under-identified. An example may clarify the notion. Consider the following model.

$$Q_D = Q_S \quad \dots \quad \dots \quad \dots \quad (7)$$

$$Q_D = a + bP + w \quad \dots \quad \dots \quad \dots \quad (8)$$

$$Q_S = c + dP + eR + v \quad \dots \quad \dots \quad \dots \quad (9)$$

where  $Q_D$  is the demand for some good,  $Q_S$  is the supply of the same good,  $P$  is the price of the good,  $R$  is the annual rainfall and  $w$  and  $v$  are error terms.

If the third equation is the one we are concerned with the parameters are not identifiable. If we multiply the second and third equations by  $\frac{1}{2}$ , and add them we get:

$$Q_S = \frac{a+c}{2} + \frac{b+d}{2} P + \frac{e}{2} R + \frac{w+v}{2} \quad (10)$$

This equation is of the same form as the third equation of the model since it says that supply is linearly dependent on price and rainfall subject to random error. The only change is in the parameters and the random variable. An infinite number of similar linear combinations of the supply and demand functions can be formed from the model which are statistically indistinguishable from the supply function. The parameters of the third equation are therefore not identifiable. However, the same result does not apply to the demand equation. Any linear combination of the demand curve and supply curve introduces the variable  $R$  into the equation, and data which satisfies the demand equation will not equally well satisfy a linear combination of the demand and supply equations because the variable  $R$  is introduced. Because  $R$  is exogenous it is statistically independent of the error term, and therefore its influence cannot be concealed in that error term.

Having illustrated the nature of the identification problem,

we will now have a brief look at two criteria which indicate whether or not the problem exists for any particular equation of a model.

### 1. The order condition

This condition is not sufficient in itself, but must be satisfied for the parameters to be identifiable. For the particular equation considered, the number of variables excluded from that equation which appear elsewhere in the model must be at least equal to the number of equations in the model less one.

Returning to the model used to illustrate identifiability in the case of the equation of supply, the only variable excluded is  $Q_p$ , and the number of variables required to be excluded is two. For the demand equation, the variables  $R$  and  $Q_s$  are excluded, so the parameters of this equation satisfy the order condition and may be identifiable.

### 2. The rank condition

This is a both necessary and sufficient condition for the identification of the parameters of an equation. The parameters in the model not appearing in the equation being considered can be formed into a matrix. If from this we can obtain at least one square sub-matrix of the order  $(G - 1)$ , where  $G$  is the number of equations in the model, whose determinant is some figure other than zero, then the parameters in the equation being considered are identifiable. In the second equation of the model the variables excluded are  $Q_s$  and  $R$ . The parameters of

these variables form a matrix:

$$\begin{array}{cc} Q_3 & R \\ \left[ \begin{array}{cc} 1 & o \\ 1 & e \end{array} \right] \end{array}$$

This matrix is itself of the order  $(G - 1)$  where  $G$  is the number of equations in the model and it has a non-zero determinant, so the parameters of the second equation are identifiable. For the third equation the only variable excluded is  $Q_p$ , and the matrix of parameters formed is  $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$  from which no square sub-matrix of the order  $(G - 1)$  can be formed. Therefore, the parameters of the third equation are not identifiable.

In the demand-for-money function to be fitted in the analysis which follows, these tests cannot be employed because the full model of which the relationship forms a part has not been specified. Nevertheless when the results of the estimation are being considered it should be remembered that the identification problem exists and that there is a very real possibility that the parameters being estimated are not identifiable.

Before leaving the question of the limitations of empirical investigations of the demand for money we must emphasise their importance and stress the danger of relying too heavily on the conclusions that will be drawn from the empirical work based on Australian data to which we now turn.

## B. The Analysis

The relationship examined is based on the propositions formulated in earlier chapters and summarised at the end of chapter three.<sup>12</sup> The function was fitted for two periods, one covering the fiscal years 1913-14 to 1960-61, and the other the fiscal years 1945-46 to 1960-61. The estimation of the parameters of the function for other time periods and other variables would have been desirable but limitations imposed by time and the availability of information rendered this impracticable. All the variables used in the analysis other than the rate of interest and the rate of change of prices are per capita figures and are deflated using the price index given in the appendix to this chapter. The variables used are as follows:<sup>13</sup>

The dependent variable (M) is the 'real' quantity of money per capita as measured by the sum of cash in the hands of the public and deposits with trading and savings banks.

The explanatory variables are:

$r$ , the rate of interest as measured by the average yield on short-term to medium-term government securities.

$Y$ , real income per capita is represented by deflated gross national product for the period 1945-46 to 1960-61 and for the

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12. See pp. 84-85 above.

13. The particular series used to represent the variables are treated in greater detail in the appendix to this chapter, many of the statistics used having been drawn from different sources and spliced, particularly for the period 1913-14 to 1960-61.

Table 1

## Results of the empirical investigation

	Regression 1					Regression 2				Regression 3		
Parameter	$\alpha_1$	$\alpha_2$	$\alpha_3$	$\alpha_4$	$\alpha_5$	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_1$	$\beta_2$	$\beta_3$
Parameter estimate	0.128	2.002	0.405	0.167	0.174	0.214	0.030	0.388	0.156	0.219	0.463	0.374
Direction of correlation	+	-	+	+	+	+	-	+	+	+	-	+
Standard errors	0.089	0.147	0.047	0.183	0.08	0.013	0.024	0.012	0.039	0.037	0.064	0.036
Partial Correlation coefficient	0.114	0.105	0.825	0.049	0.218	0.444	0.0001	0.757	0.038	not calculated		
't' test for $\alpha$ hypothesis that true parameter value is zero.	A	A	R	A	A	R	A	R	R	R	A	R

\* The hypothesis is admitted or rejected as the case may be at both the 1% and 5% levels of significance except for  $\alpha_2$  which is admitted at the 1% level only. 'A' signifies the admission of the hypothesis and 'R' signifies its rejection.

period 1913-14 to 1960-61 estimates of deflated national income are used.

D, real outstanding government debt per capita includes the holdings of Commonwealth, state, local and semi-government bodies, again the figures being deflated.

P', the rate of change of the price level is represented by the ratio of the current year's retail price index to that of the previous year. The result is expressed as a percentage. The same price index was used in deflating the statistics which appeared in money terms to get estimates of 'real' magnitudes.

E', the rate of change of share prices used as a supplement or alternative to the rate of change of retail prices, is incorporated only in the shorter examination, as observations on it are not available for the period from 1913-14. The index used is based on the market prices of the shares of a number of N.S.W. companies, and once again the rate of change is taken as the ratio of the current year's index to the previous year's index.

All the regressions fitted were of linear form, and using the least squares method of estimation, the following results were obtained:

1945-46 to 1960-61

$$M = 7.97 + 0.128Y - 2.002r + 0.405D + 0.167P' + 0.174E' \quad (11)$$

$$\text{Multiple correlation coefficient } (R^2) = 0.970$$

1913-14 to 1960-61

$$M = 4.85 + 0.214Y - 0.030r + 0.388D + 0.156P' \quad (12)$$

$$R^2 = 0.948$$

$$M = 23.39 + 0.219Y - 0.463r + 0.374D \quad (13)$$

$$R^2 = 0.946$$

Table 1 <sup>14</sup> presents other results of the examination together with the parameter values given in the regressions above.

C. Discussion of the Results

I. For the regressions

Table 1 records most of the results of the regressions given on the previous page. Basically the results of the different estimates are very similar. The multiple correlation coefficients are high for all the regressions. However the differences between these coefficients are perhaps smaller than expected. A higher correlation coefficient would be expected when more relevant explanatory variables are included in the regression. The regression (13) has a correlation coefficient of 0.946. The regression (12) which includes the rate of change of retail prices as an additional explanatory variable would be expected on a priori grounds to yield a higher coefficient or correlation. In fact the rise is imperceptible from 0.946 to 0.948 and the partial correlation coefficient of the rate of change of prices is close to zero. The only other change resulting from the inclusion of the rate of change of prices is in the estimate of the rate of interest

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14. See p. 206 above.



parameter. The estimated parameters for the variables 'income' and 'outstanding government debt' show little difference for the two regressions, the only marked change being a relatively large reduction in the parameter estimate for the rate of interest in the regression incorporating the rate of change of retail prices. The third regression which includes a fifth explanatory variable, the rate of change of share prices, results in a significantly higher correlation coefficient than for the other two estimates. This, or even a greater difference, is to be expected because of the inclusion of further explanatory variables, and because the period being considered is much shorter, and therefore the opportunities for changes to occur in those factors not included in the estimation are more limited. For instance changes in tastes and habits are likely to be considerably smaller over a fifteen-year period than over a fifty-year period.

As would be expected because there are fewer observations, the standard errors are considerably higher for the parameters estimated for the 1945-46 to 1960-61 period and also the 't' test does not yield nearly as satisfactory results for this period as for the parameter estimates for the period 1913-14 to 1960-61.

In all the regressions the parameter estimates follow the same pattern. For example, income and outstanding government debt are directly related to the quantity of money in all cases, and the rate of interest is inversely related. In all cases the variable outstanding government debt appears as the most important explanatory variable. Its partial correlation coefficient is very high,

particularly for the period 1945-46 to 1960-61. With the inclusion of the rate of change of share prices, and with the estimation being taken over the shorter period, the partial correlation coefficient for the interest rate is much higher than for the longer period where it is virtually zero. The rate of change of share prices in the estimate for the shorter period has a much higher partial correlation coefficient than does the rate of change of retail prices. The changes in the regression for the shorter period are that the partial correlation coefficient and the parameter estimate for the income variable are much lower and that the hypothesis of zero correlation between the quantity of money and income becomes tenable on the basis of the 't' test.

There are thus no startling differences and generally there is a close correspondence between the different regressions. The parameter estimates retain the same signs throughout and the multiple and partial correlation coefficients are broadly similar. The primary difference is the relative importance of the explanatory variables. Only the variable outstanding government debt, and possibly the rate of change of retail prices retain anything like the same relative importance in the three estimates. The estimate for the 1945-46 to 1960-61 period does not perform as well as the other estimates when subjected to the 't' test, though this is attributable mainly to the smaller number of observations in the sample used for the estimate.

At this stage, having discussed results of the estimates in general terms we shall now consider the results for each variable separately.

## II. The results for each of the explanatory variables

### (i) Outstanding government debt

The empirical results in the case of this variable are highly significant and the size of the coefficient varies little between the three regressions. A strong and close connection between the quantity of money and outstanding government debt is indicated. The analysis yields a direct relationship between the two variables and at this stage it seems appropriate to consider to what extent this conforms with expectations. There are a number of possible arguments in favour of the type of relationship found which warrant consideration.

The first is that since total outstanding government debt is a considerable part of total wealth we would expect it to be highly correlated with total wealth but as we have seen in the third chapter there are strong a priori reasons for supposing total wealth and desired money holdings to be directly related, consequently we would expect total outstanding government debt to be directly related with desired money holdings.

Another possible argument for a direct relationship between the two variables is that both will be affected in the same way by prevailing economic conditions. The argument can be presented in terms of boom conditions. Under boom conditions it is likely that the quantity of money will increase whether or not monetary policy is aimed at such an increase. If this be granted the question is whether or not the rate of issue of government securities will also increase under such conditions. This will depend firstly on the

ability of the authorities to make new issues on reasonable terms and secondly on the need to make these issues. Since many opportunities for the use of funds are available in conditions of boom the authorities may be able to float new issues internally to the desired extent only if there is a high level of liquidity in the economy, particularly amongst banks and other financial institutions which are large investors in government securities. Therefore, unless the interest rates on government securities are relatively high or if the authorities are prepared to increase the rate of interest on government securities then unless the economy is highly liquid it would seem that the authorities may be restricted in their ability to float new issues of securities internally. On the other hand, it is likely that funds from overseas will be more freely available in times of boom. There remains the question of the need to make new issues of securities. If economic policy is designed to modify boom conditions the spending of the government sector should be restricted in time of boom. However, a great deal of government expenditure may be necessary in boom conditions to accompany the development of the private sector. For example the expansion of industry may require considerable government expenditure in the fields of power and transport. Therefore in spite of the requirements of economic policy government expenditure may need to increase in times of boom. This increase in government expenditure may however be financed from taxation revenue and indeed should be according to generally accepted principles of fiscal policy. Thus it is difficult to say whether or not there is a need for an

increase in the rate of issue of government securities in times of boom. The same line of argument may be applied to other economic conditions to reach similar indeterminate conclusions.

It is clear from the foregoing that the argument is somewhat inconclusive. While the quantity of money is likely to increase in times of boom it seems that the rate of new issue of government securities could move in any direction at all.

The second argument relates to the sources of change in the stock of government securities. The next argument on the other hand relates to changes in the value of the existing stock; that is to movements in security prices. The first point here concerns the practice of engineering changes in the quantity of money by means of open-market operations. To the extent that the authorities indulge in this practice we should find a direct relationship between the value of total government debt and the quantity of money. For example if the authorities buy government securities in order to increase the quantity of money they will force up security prices and so bring about an increase in the value of total government debt. However this point is of little importance for the Australian economy since open-market operations in the traditional sense are limited in this country. In the case of the Australian security market the intervention of the authorities is directed more towards the stabilising of security prices than towards manipulating the stock of money. This brings us to a second point which provides some support for the belief that the quantity of money and the value of outstanding government debt will not move inversely. If the

authorities are completely successful in their policy of stabilising security prices then we would expect a zero correlation between the quantity of money and the value of total government debt. If they are not completely successful we would however expect an inverse relationship to result. Suppose for example that the authorities buy securities in order to stop bond prices from falling. The result will be an increase in the stock of money and, because the aim of price stability is not fully realised, security prices fall.

If open-market operations are used in the traditional sense we would expect a direct relationship between the stock of money and outstanding government debt. If the aim is instead one directed at stabilising security prices, as is the case in Australia, we would expect an inverse relationship. However it is a weak argument and is in any case not relevant to our analysis as the series used<sup>15</sup> measures the total value of outstanding debt at par prices not at market prices.

A number of factors must be taken into account in considering the relationship between the quantity of money and outstanding government debt. Several arguments have been dealt with briefly. The first provides strong support for a direct relationship between the two variables. The second argument is inconclusive. It does not provide strong grounds for expecting either a direct relationship or an inverse relationship between the two variables. The final argument supports an inverse relationship. However, as has been

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15. Details of the series used are included in the appendix to this chapter.

seen the argument is not relevant for this analysis.

It may be of interest to note that if the variable used had been the private sector's holdings of government securities<sup>16</sup> rather than the holding of the community at large the position would have been if anything less clear-cut. On the one hand there is a strong argument for expecting an inverse relationship between the variables. This is based on the fact that although outstanding government debt includes long-term securities it is nevertheless likely to be a fairly close substitute for money as next to money securities are amongst the most liquid assets, particularly in view of the marked stability in security prices. If this is so then the relationship between the two variables should be an inverse one. People aiming to maintain a more or less constant liquidity position may do so by holding more money and less bonds or more bonds and less money. In opposition to this it might be urged that the response of security holders to an increase in their money holdings may be not to increase their total security holdings but to shift their holdings of securities, or part of them, into short-term securities, these being less subject to price variations than long-term securities and therefore more liquid. The overall result would then

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16. Of the analyses considered in chapter four only Turvey's uses the private sector's holding of government debt as an explanatory variable. However we cannot tell from his empirical results what direction the relationship between the quantity of money and the private sector's holding of government debt assumes because he uses an interest rate as the dependent variable in all his regressions and only includes the quantity of money as an explanatory variable.

be little or no change in the total security holdings of the individuals concerned in response to a change in the quantity of money - in other words a neutral result.

On the other hand there is an argument for the view that there will be a direct relationship between the quantity of money and the private sector's holding of government debt. Suppose that monetary policy is applied through a system of direct controls over the trading banks' liquidity. When the authorities in Australia are trying to reduce the money supply by reducing the liquidity of the trading banks as has been the case in Australia in the post-war years (for instance using statutory reserve deposits) the banks may well sell securities in order to maintain their liquidity position. When they are trying to increase the supply of money by increasing trading bank liquidity the banks will expand advances, but in the first instance at least they will not only expand advances but will tend to expand their security holdings also. It is unlikely that the expansion or contraction of the banks' security holdings will be effected by transfers between the bank and non-bank parts of the private sector. For example when there is a reduction in trading banks' liquidity the banks will not only sell securities but will restrict advances as well. In this way the rest of the private sector will feel the restriction and so far from buying securities which are being sold on the market by the banks they will be anxious to sell securities themselves in order to reduce their liabilities with the banks. Therefore, the transfers of securities which result from changes in the quantity of money will



take place mainly between the private and public sectors so that the private sector's holding of government debt will change in the same direction as the quantity of money. Thus it would appear that for this form of monetary policy, changes in the quantity of money will be associated with changes in the private sector's holding of government debt in the same direction.

The above argument assumes that the public sector is prepared to buy the securities offered on the market by the private sector. In fact this may not be the case. If for example the authorities have reduced the liquidity of the trading banks with the aim of reducing the quantity of money they should not then buy securities on the market since to do so would be to apply, in effect, two distinct and conflicting policy measures. If we assume that the authorities, when operating directly on the money supply neither buy nor sell securities, then the relationship between the quantity of money and the private sector's holdings of government debt will be a neutral one. However, as was mentioned earlier in the chapter<sup>17</sup> the authorities may in fact not adopt a neutral position, as their prime concern in relation to the market for securities is to maintain a considerable degree of price stability. This may force them to buy securities in order to keep prices stable, thereby increasing the quantity of money at the same time as they are attempting to reduce the quantity of money by a direct reduction of trading bank liquidity.

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17. See p. 213 above.

Thus, if we were considering the private sector's holdings of government debt there would be two conflicting factors to take into account. The first factor considered indicates an inverse relationship between security holdings and money holdings whereas the second factor relating to direct control of trading bank liquidity indicates direct relationship between the two variables.

(ii) The rate of interest

We turn now to an examination of the results relating to the rate of interest. The extremely small correlations between the rate of interest and the quantity of money which were obtained in all three regressions contrast with the results produced by many other analyses and fall short of expectations.<sup>18</sup> The results obtained in the analysis of Australian data raise two distinct questions.

The first is whether in fact under Australian conditions we have any justification for expecting a strong inverse relationship between the quantity of money and the interest rate represented in our analysis by the yield on government securities. The argument in favour of such a relationship is that the higher the yield, the higher the cost of holding money and the stronger the expectations of a fall in the yield. For both these reasons, the quantity of money desired will tend to vary inversely with the average yield.

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18. It will be recalled from chapter four that the results of other analyses in many cases support the notion of an inverse relationship between the quantity of money and the rate of interest. However it must be noted that some of the analyses examined such as those by Friedman and Bronfenbrenner and Mayer found the rate of interest of little importance in explaining

There are however good reasons why this relationship may not be a strong one. One is that since financial institutions are the main operators in the security market it may be that an observed rise in the rate of interest is the result of an increase in the rate of sales of securities by financial institutions which is designed to permit an expansion of their lending. In such a case the yield on securities and the quantity of money would move in the same direction and so offset the inverse connection noted above. A much more important reason lies in the nature of government operations in the security market. As has been mentioned earlier in this chapter<sup>19</sup> the main aim of intervention by the authorities in the security market in Australia is stability of security prices rather than management of the quantity of money which means in effect that the suppression of any inverse or other connection between the quantity of money and the yield on securities has been a matter of monetary policy in the post-war period.

The second question raised by our analysis is whether an inverse relationship between desired money holdings and the yield on securities exists but has been obscured by the nature of the analysis. One possibility is that the weak parameter estimates and the low partial correlation of the rate of interest with the quantity of money is attributable to the assumption of linearity made in all three regressions. There may be other forms which would

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19. See p. 213 above.

provide a closer relationship - for instance a hyperbolic form as suggested by the results of some of the studies examined in the previous chapter and by Keynesian theory.

Another possibility is that the rate of interest used is not entirely satisfactory. In order to get a satisfactory rate the yield should be adjusted for taxation<sup>20</sup> and for the costs of purchasing securities (such as brokerage and stamp duty). These adjustments would give us an effective measure of the cost of holding money.

A third possibility is that the weak results are due to the length of the periods used in the regressions. The periods used are relatively long periods, even the sixteen-year period, but particularly the period from 1913-14 and it may be that analyses conducted over shorter periods would show a closer connection between the quantity of money and the rate of interest. To see this it is necessary to recall that in Keynesian theory<sup>21</sup> expectations about the future of the rate of interest are bound up with the relationship between the actual rate and the normal rate. Now the normal rate of interest is governed by what people consider to be a reasonable and justifiable rate and will therefore be primarily determined by the market rates of the recent past and so will be subject to long-run variations. Thus while a short-period analysis can proceed on the assumption of a constant normal rate of interest,

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20. This cannot be done with precision in an economy with a progressive system of taxation.

21. See chapter two above.

unless the period happens to be one of rapid and marked economic fluctuation, in a long-period analysis such as ours the likelihood of variation of the normal rate of interest needs to be taken into account. This means that while the actual rate of interest itself is the appropriate explanatory variable in a short-period analysis an appropriate variable in the long-period analysis would be the excess of the rate of interest over the normal rate. Thus if the raw interest rate is used the analysis may not reveal any close relationship between the quantity of money and the rate of interest. This conclusion receives some support in the regressions as the money-interest rate relationship though not statistically significant in any of the regressions was more significant in the regression for the shorter period.

Before dismissing the rate of interest on empirical grounds as an important determinant of the demand for money there are a number of avenues of which can be explored: if approximations to the normal rate of interest cannot be determined then short period analyses should overcome the problem arising from variations in the normal rate; different interest rates can be used (though the number of freely determined market rates is limited) and functions of different forms may be tested. There are, therefore, a number of possibilities for empirical investigation. Certainly before the rate of interest can be dismissed on empirical grounds, the possible reasons proposed above for its lack of significance in this analysis should be fully investigated. Although, at times, too much emphasis is perhaps placed on the role of the rate of interest, there are

sound a priori grounds for believing it to be of significance in determining the demand for money.

(iii) The rate of change of prices

The rate of change of prices did not provide satisfactory results in the analysis. The direction of the variation with the quantity of money is the reverse of what was expected, and the partial correlation coefficients for both the rate of change of retail prices and the rate of change of share prices are low. Neither variable stands up to the 't' test in regression (11)<sup>22</sup> though the only price variable included in the other regressions (retail prices) stood up to the test. The results do not indicate much support for the rate of change prices as an explanatory variable in a demand-for-money function. Such a conclusion would be in accord with most other analyses of the demand for money which either ignore the price variable or dismiss it after examination.

Perhaps the most disappointing feature of the price-money relationships is their direction. The expansion of money holdings as the rate of change of prices increases appears inconsistent, as capital losses are thereby incurred. It is possible that the rate of change of prices is not a good measure of expectations regarding prices, but the conclusion that expectations and actual changes will move inversely appears somewhat untenable, particularly in a period when the rate of change of prices has been very stable for long

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22. The hypothesis that the true values of the parameters of both price variables are zero had to be admitted.

stretches of time.

A more likely explanation of the positive relationship between the quantity of money and the price variable, and the only reasonable alternative apparent, is that the relationship observed is one of supply, or at least one dominated by supply elements. As the stock of money has increased so have prices due to the fact that individuals and businesses find that their holdings of money are higher than desired and so seek to transfer a portion of their money holdings into assets. If the relationship revealed in the regressions is one of supply, and so a rise in prices and in the quantity of money are associated as described above, then the inverse demand relationship may well exist but be over-shadowed by the supply relationship.

(iv) Gross national product

Gross national product, included in the regression to indicate transactions requirements yielded satisfactory results in the second and third regressions. The regression for the 1945-46 to 1960-61 period may be written as:

$$M_1 = 0.128Y \quad \dots \quad (11a)$$

$$M_2 = 7.97 - 2.002r + 0.405D + 0.167P^t + 0.174E^t \quad (11b)$$

where  $M_1$  represents the quantity of money required for transactions and  $M_2$  represents all other money holdings (idle balances).

From the first function we can derive the income velocity of circulation of active balances,  $(Y/M_1)$ : The resulting velocity

is  $\frac{1}{0.128}$ , or approximately eight. The partial correlation coefficient of the income variable is 0.114 and the hypothesis of a true value of zero for this variable is tenable in the light of the 't' test. In the regressions (12) and (13) income velocity is estimated in the same way. For regression (12) the velocity estimate is  $\frac{1}{0.214}$  or approximately  $4\frac{2}{3}$  while the estimate for regression (13) is  $\frac{1}{0.219}$  or slightly more than  $4\frac{1}{2}$ . The partial correlation coefficient in regression (12) is much higher at 0.444 than for regression (11) (the partial correlation coefficients were not calculated for regression (13)). Also the hypothesis that the true value of the parameter is zero was rejected for both regressions (12) and (13). The results are markedly better for the latter regressions than for regression (11).

The difference in the velocities given by regression (11) and regressions (12) and (13) indicates that a significant change may have occurred in the post-war years, either in the financial habits of individuals and firms, or in the institutional arrangements for the payment of debt<sup>23</sup> or both. As far as habits are concerned probably the most significant developments are the greater security of employment and therefore of income and the higher levels of income received. These factors will lead to holdings of precautionary balances being reduced in relative terms. There is no longer the same need for the individual to provide for contingencies,

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23. Selden, R. T. Post-war Rise in the Velocity of Money: A Sectoral Analysis (in J. Finance. Vol. 16, No. 4: 483-545, 1961). In his article Selden dismisses the importance of the influence of institutional or distributional changes on the demand for money in the period since 1945 for the U.S.



particularly the possibility of unemployment. Similarly for the firm the need to hold cash balances to tide it over a period of rising stocks and falling sales will be lessened and therefore the need for contingency balances will decrease. Another significant development is the marked trend of the post-war years towards increasingly large corporations both by means of internal growth and external expansion (by means of mergers and takeovers). With this increase in the size of firms has come bargaining power<sup>24</sup> which enables the firm to obtain loans more easily from the banking system and to obtain more favourable terms of payment from other firms with which they are associated and so sustain a given turnover on smaller active balances. Further the growth of corporations may result in many former inter-firm transactions becoming intra-firm transactions. In this way increases in the level of transactions over time will not be accompanied by increases in active balances of the same relative magnitude. As regards institutional changes probably the main developments are of trade credit and consumer credit. The expansion in both these fields, particularly in the field of consumer credit in the post-war period would be expected to reduce the active balances which firms and individuals would need to support a given level of transactions.

Changes of this sort would lead to changes in the velocity

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24. This point is considered earlier (chapter four, pp. 115-116) when discussing the analysis by: Rousseas, S. W. Velocity Changes and the Effectiveness of Monetary Policy (in Rev. Econ. Stats. Vol. 42: 27-36, 1960).

in the same direction as that observed and may well have been sufficient to lead to a change in the velocity in the post-war period of the magnitude observed. The change in the velocity indicated by the regressions is all the more striking in view of the fact that the longer period for regressions (12) and (13) covers the period for regression (11) as well. This would seem to indicate that the difference in the velocity between the two periods 1913-14 to 1944-45 and 1945-46 to 1960-61 is somewhat greater than the comparative velocities indicated by the regressions.

The low partial correlation coefficient of 0.1 for income in regression (11) and the not encouraging results of the 't' test indicate that the relationship fitted between money and income is perhaps not very significant. However, the unsatisfactory results in regression (11) may stem from constant changes in income velocity over the post-war years, changes which are attributable to the social and institutional factors described above. If continual changes have been taking place in income velocity in the post-war period, then no single constant relationship could be observed between money and income, and a function fitted for the period would consequently not be expected to yield highly significant results. Certainly this conclusion is supported by the increase in velocity observed between the first and second regression.

#### D. Conclusion

The results of the analysis presented in this chapter might usefully be compared with the results of other empirical analyses summarised at the conclusion of chapter four. In the simple idle balances-interest rate function an inverse relationship was indicated in all cases although the degree of correlation generally suggested that the rate of interest is not alone sufficient to explain desired idle balances. In analyses which extended the function to include other explanatory variables the rate of interest was sometimes found to be a secondary factor and at times a factor of very little importance at all. The one outstanding feature is that at all times an inverse relationship between the quantity of money or idle balances and the rate of interest was apparent. The results of the present analysis lend some support to the hypothesis that desired idle balances and the rate of interest are inversely related but they do little else except in casting considerable doubt upon the importance of the relationship. In the empirical analyses discussed in chapter four the income variable was generally fairly closely correlated with desired money holdings and provided support for the notion of a positive relationship between these two variables. The results of the analysis of this chapter are in accord with these conclusions both in the direction and importance of the relationship. Once again in the case of the variable total assets the results of this chapter and the analyses examined in the preceding chapter are in agreement in so far as

total outstanding government debt can be taken to behave like total assets and is thus a suitable indicator of total assets. This variable has a positive correlation with desired money holdings, and furthermore it has a very high partial correlation coefficient. It is certainly easily the most important of the explanatory variables examined and provides some justification for Lydall's<sup>25</sup> belief that desired idle balances will be determined almost entirely by total assets. Finally we come to the empirical results relating to rates of price change. Two price indexes are used in this chapter - retail prices and share prices. The series on rates of price change derived from these are in all cases found to be positively correlated with the quantity of money. In fact this is the opposite to the result expected in a priori grounds. In the analyses of the previous chapter the rate of change of prices was examined and in two of the three analyses in which this was done it was rejected as of minor importance on statistical grounds. In the one case in which it was retained the rate of change of prices was inversely correlated with idle balances and was highly significant. Thus although the results for the rate of change of prices are generally statistically more significant than are those for the rate of interest, the results are if anything less satisfying than those obtained for the rate of interest due to the unexpected direction of

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25. Lydall, H. F. Income, Assets and the Demand for Money (in Rev. Econ. Stats. Vol. 40: 1-14, 1958). This analysis is discussed in chapter four, pp. 157-160 above.

the correlation between the quantity of money and the rate of change of prices.

The analysis therefore provides results which are generally consistent with the results of other analyses. Also the results generally support a priori conclusions, except for the rate of change of prices and although there are some surprises regarding the importance of different explanatory variables. In particular outstanding government debt and the rate of interest play respectively more important and less important roles in determining desired idle balances than was expected. The most notable feature of the analysis is the support provided for the existence of a stable function which will explain the greater part of money holdings in Australia over considerable time periods, as indicated by the high multiple correlation coefficients for all the regressions. However the high multiple correlations appear to be largely attributable to the variable outstanding government debt. The other variables generally appear to have less important functions than supposed. In the case of the variable rate of change of prices, not only were the statistical results unsatisfactory, but the direction of its relationship with the quantity of money was the reverse of that expected. Neither the rate of interest, nor income appear to be as important as expected particularly in the case of the rate of interest. There are however many avenues for further empirical research which will be discussed in the final chapter, and until these avenues are explored the results of a limited examination such as this one must be of a tentative and conditional nature.

## Appendix to Chapter 5

### Sources of the Series Used in the Regressions

The tables at the end of this appendix give the essential data used for the regressions discussed in the present chapter. As expected data was difficult to obtain, particularly for the 1913-14 to 1960-61 period and as a result there are considerable variations in the reliability of the time series which have been used. Many of the series consist of a number of sub-series which vary significantly in their coverage and where a single and consistent series is used the advantage derived from this consistency is often offset by other disadvantages such as less relevance.

#### I. Price indices

All the series other than interest rates and rates of price change are deflated according to population growth and price changes - i.e. expressed as pounds per capita in the price level of some base year. For the period 1913-14 to 1960-61 the price series is drawn from the Labour Report with the exception of 1960-61, the figure for which is drawn from the Quarterly Summary of Australian Statistics. Up to 1949 the "C" Series Retail Price Index is used and for all subsequent years the Consumer price index. In each case the index is a weighted average of quarterly figures for the year ended June 30th except for the years 1913-14 to 1921-22 which are measured for the year ended November 30th. This price

index series is used for deflating the series which are expressed in terms of money and for obtaining the series on the rate of change of the price level. For the 1945-1961 period the "C" series index is used up to the year 1952 and for all the following years the Consumer Price Index is used. Both series are taken from the Statistical Bulletin of the Reserve Bank and are spliced with the base of the new composite series being the average for the years 1937 to 1939 equal to one hundred. The figures used are all for the June quarter of each year and this accounts for differences revealed in the tables between these figures and those included in the corresponding part of the 1914-1961 series, which are averages for the four quarters of each year.

The share price index in Table II is drawn from the Monthly Review of Business Statistics and is an average of market prices for seventy-five selected New South Wales companies. The figures are all averages of monthly figures for the twelve months to June. The series for the rate of change of share prices in Table II is compiled by taking the ratio of the current year's share price index to that of the previous year expressed as a percentage.

## II. The volume of money

A continuous series on the volume of money back to 1913-14 is not available from Reserve Bank reports. The source used is the Quarterly Summary of Australian Statistics. This gives series on: cash in the hands of the public and deposits with savings banks measured as at June 30th, and interest-bearing and non-interest-bearing deposits with the cheque-paying banks measured as averages of deposits

at the close of business on Wednesdays for each year ended June. These series were added together to obtain a volume of money series. Reserve Bank volume of money estimates are available from 1939 onwards, but since the quarterly figures of interest-bearing deposits include government accounts, there are significant quantitative differences between the two series. Therefore, for consistency the series on the volume of money which is used for the 1914-1961 period is drawn entirely from the Quarterly Summary of Australian Statistics.

For the 1946-1961 period the volume of money series is drawn directly from the Statistical Bulletin of the Reserve Bank, and consists of: notes and coin in the hands of the public and deposits with cheque-paying and savings banks adjusted for interbank and commonwealth and state government deposits. The figures are weekly averages for the month of June.

### III. The level of income

The series on the level of national income involved considerable problems. From 1939 to 1961 estimates are provided in the annual paper, National Income and Expenditure. For the preceding ten years estimates were obtained from The Australian Balance of Payments. For the years prior to 1929 the estimates used are not entirely satisfactory. Estimates for the three years 1913-14, 1915-16 and 1919-20 are those made by J. T. Sutcliffe,<sup>26</sup> and the series is completed with estimates taken from The National

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26. Sutcliffe, J. T. The National Dividend. 1926.



Income of Australia.<sup>27</sup> The estimates used as stated, though not resulting in a series of a completely homogeneous nature, are certainly the best set of estimates readily available, and in fact where the sub-series overlap a reasonable degree of correspondence was shown.

In the period 1945-46 to 1960-61 the series used is that on gross national product drawn from the National Income and Expenditure papers. This series of estimates is more satisfactory, having been arrived at by consistent methods than is the series for the period 1913-14 to 1960-61.

#### IV. The rate of interest

The rate of interest is a series on government security yields. The figures for the period from 1913-14 consist of a number of sub-series which were chosen with the aim of as high a degree of consistency as possible for the whole series. However, considerable variations in the maturity periods of the securities considered, particularly in the early years, were unavoidable from one sub-series to the next. To 1927-28 the yield taken was on three percent stock with a minimum maturity date in 1921 and a maximum maturity date in 1930 taken from the Year Book of Victoria. For the following period to 1936-37 the New South Wales Statistical Register was the source. For the first two years of this period 1928-29 and 1929-30, the yield was the average on stocks of all maturities. For the

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27. Clark, C. and J. G. Crawford. The National Income of Australia. 1938.

subsequent period the yield taken was on securities with a maturity of from five to ten years. The Reserve Bank Statistical Bulletin provided the yields for the remaining years. From 1937-38 to 1941-42 the yields are on securities with less than five years to maturity, and from 1942-43 to 1960-61 on securities with less than two years to maturity. The yields for all years after 1941-42 are adjusted for tax rebates granted on income derived from securities. It is apparent that the yield series which has been described tends to relate to securities with progressively shorter periods to maturity, and is due to limitations in the information available about securities of different maturity periods, particularly in the early years. The series used in the analysis of the 1945-46 to 1960-61 period is identical with the yields already described as obtained from The Reserve Bank Statistical Bulletin. For the whole period from 1913-14 the yields are measured at June of each year except for the year 1930-31 when the figure taken is for the year ended October.

#### V. Outstanding government debt

The total outstanding government debt is measured at June 30th and includes all commonwealth and state public debt. The data used is drawn from the Finance Bulletin and covers all holders, both public and private, of government debt. The total debt is measured in terms of the par values of securities as contrasted with measurement in terms of market prices. The series used for both periods, 1913-14 to 1960-61 and 1945-46 to 1960-61, covers all holders of government debt. It may be interesting to note that if we were

interested simply in the private sector's holding of government debt information is available for the period from 1945-46 in a special Financial Supplement of the Statistical Bulletin of the Reserve Bank issued in September, 1960.

## VI. Population

The population figures in Table III are drawn from the Demography Bulletin except for the years 1959-60 and 1960-61 which are drawn from the Monthly Review of Business Statistics and Census Reports respectively.

Finally it should perhaps be stressed that limitations of the data impose severe restrictions on the usefulness of the empirical investigations undertaken in this chapter. For example we have been unable to incorporate the variable total assets in the calculations due solely to the absence of information about it. Also very little information is available about important component parts of total assets. Variables such as this warrant investigation, not only in relation to the field of monetary theory being considered here, and much more information is required about them. However, the complete lack of information is only one of a number of obstacles encountered. The effects of poorly conceived and presented information cover a wider field and in their overall influence are perhaps more restrictive. It is apparent that the whole process of empirical research is restricted and could be much simpler and more effective if the presentation of information could be improved.

Possibly improvement in this sphere could be brought about

by the publication of a suitable index giving details of all the statistics available from all sources, and by the collection of the more important statistics into one or two publications.

Secondly the usefulness of statistics could be increased by improving current collections, revising past statistics, or where these do not exist by making fresh estimates where possible, and in this way building up consistent estimates of important variables over long periods.

TABLE II

## SERIES USED IN REGRESSION (1)

Year (ended June 30th)	Volume of Money (£'s per capita)	National Income (£'s per capita)	Interest Rate (%)	Retail Price Index (Base 1936-7 to 1938-9 = 100)	Share Price Index	Retail Price Index (% ratio of previous year)	Share Price Index (% ratio of previous year)	Public Debt Outstanding (£'s per capita)
1945	-	-	-	127	106	-	-	-
1946	158.57	154.83	1.79	129	116	101.57	109.43	235.31
1947	154.93	164.33	1.92	132	133	102.32	114.13	232.30
1948	147.56	183.41	2.34	144	145	109.09	109.43	211.88
1949	143.34	181.36	1.97	158	143	109.72	98.34	192.00
1950	130.91	190.32	1.95	173	149	109.49	104.56	176.68
1951	139.67	207.07	2.05	207	185	119.65	123.74	152.81
1952	112.07	178.62	2.21	249	166	120.25	90.08	132.96
1953	115.11	184.00	3.16	259	140	104.01	84.12	132.23
1954	118.02	222.50	3.42	264	148	101.93	105.51	134.28
1955	116.48	198.06	3.74	269	163	101.89	110.24	133.90
1956	111.35	202.95	5.13	285	173	105.95	106.15	131.76
1957	109.86	203.02	4.62	295	171	103.51	98.90	126.28
1958	107.56	197.34	4.25	298	184	101.02	107.56	120.32
1959	110.59	206.54	4.00	303	197	101.68	107.08	118.94
1960	113.56	216.89	4.19	313	272	103.30	138.25	114.42
1961	108.24	213.69	5.23	324	279	103.51	102.54	110.17

TABLE III  
SERIES USED IN REGRESSIONS (2) and (3)

Year (ended June 30th)	Popula- tion (1000)	Retail Price Index (Base: 1911 = 100)	Volume of Money (£'s per capita)	National Income (£'s per capita)	Interest Rate (%)	Retail Price Index (% ratio of previous year)	Public Debt Outstanding (£'s per capita)
1913	-	110	45.00	53.68	4.55	103.6	19.82
1914	4,949	114	42.62	48.62	4.69	114.0	20.54
1915	4,986	130	46.44	53.18	5.28	101.5	28.48
1916	4,943	132	47.66	51.42	5.95	106.8	32.98
1917	4,941	141	47.73	50.40	6.01	106.4	40.27
1918	5,029	150	45.06	45.06	6.24	113.3	39.29
1919	5,193	170	41.19	45.13	6.59	113.5	39.53
1920	5,360	193	50.18	59.58	7.30	87.0	48.57
1921	5,454	168	52.53	59.88	7.26	96.4	51.11
1922	5,567	162	53.61	61.87	6.60	102.5	50.30
1923	5,688	166	53.35	65.98	5.15	98.8	50.24
1924	5,804	164	54.06	69.21	6.10	100.6	49.88
1925	5,929	165	55.06	68.15	5.27	101.8	49.17
1926	6,044	168	55.84	71.20	5.01	98.8	50.36
1927	6,182	166	57.13	70.96	5.50	100.6	48.86
1928	6,302	167	53.04	73.10	5.52	102.4	47.66
1929	6,394	171	52.72	69.32	6.06	94.7	50.31
1930	6,463	162	54.97	59.72	6.25	89.5	58.90
1931	6,526	145	59.86	59.42	5.01	95.2	64.57
1932	6,577	138	62.03	63.61	3.63	96.4	68.87
1933	6,630	133	63.97	68.46	3.23	102.3	69.26
1934	6,676	136	63.33	69.06	3.43	101.5	70.02
1935	6,724	138	62.62	75.18	3.91	102.2	69.72
1936	6,775	141	66.00	79.38	3.65	102.8	68.07
1937	6,831	145	66.24	81.01	3.99	102.8	66.78
1938	6,893	149	64.51	75.42	3.99	102.7	66.08
1939	6,961	153	64.40	76.23	3.57	103.9	67.17
1940	7,031	159	55.81	77.72	2.51	105.0	69.46

Year	Popula- tion	Retail Price Index	Volume of Money	National Income	Interest Rate	Retail Price Index	Public Debt Outstanding
1941	7,110	167	56.57	82.71	2.46	108.4	79.50
1942	7,181	181	70.96	90.37	2.49	103.9	103.72
1943	7,235	188	85.29	93.58	2.49	99.5	131.02
1944	7,310	187	93.96	88.82	2.49	100.0	149.47
1945	7,392	187	103.95	91.58	1.79	101.6	159.74
1946	7,465	190	104.34	92.63	1.92	104.2	154.85
1947	7,579	196	98.44	105.14	2.34	110.1	139.95
1948	7,709	215	95.79	102.75	1.97	110.1	126.42
1949	7,908	240	97.86	106.53	1.95	109.2	116.68
1950	8,179	262	96.01	118.18	2.05	119.5	101.05
1951	8,422	313	79.48	102.83	2.21	117.3	90.22
1952	8,636	367	76.21	106.27	3.16	104.4	89.43
1953	8,815	383	80.78	127.10	3.42	100.8	91.84
1954	8,987	386	81.07	113.76	3.74	102.1	91.42
1955	9,201	394	76.09	112.08	5.13	106.3	87.12
1956	9,428	419	75.80	115.17	4.62	102.4	86.25
1957	9,643	429	77.03	109.93	4.25	101.4	82.99
1958	9,846	435	76.46	113.30	4.00	101.8	80.54
1959	10,061	443	77.65	118.00	4.19	103.6	76.78
1960	10,281	459	75.42	116.94	5.23	103.3	74.60
1961	10,508	474					

## CHAPTER SIX

### AUSTRALIAN MONETARY POLICY AND THE DEMAND-FOR-MONEY FUNCTION

The main purpose of this chapter is to consider some of the ways in which an empirical demand-for-money function of the sort developed in the last chapter can assist in the formulation of monetary policy in Australia. To provide a background for this discussion we begin by presenting a brief discussion of the techniques and problems of monetary policy in Australia at the present time.

#### A. Objectives of Monetary Policy

The objectives of monetary policy are:

- "(a) the stability of the currency of Australia
- (b) the maintenance of full employment in Australia
- and (c) the economic prosperity and welfare of the people of Australia."<sup>1</sup>

The third objective is a vague one. An objective which is not specifically included, but may be implied under (c) is that of balance of payments equilibrium. Also (c) would encompass the policy of rapid economic development and growth based upon and coupled with the heavy immigration program which has been pursued in recent years. It is apparent that under many circumstances these objectives may be incompatible. For example given a situation of full employment

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1. The Reserve Bank Act, 1959, Section 10.



the objective of a stable currency becomes rather difficult to attain because the economy is in a state where only a slight increase in the demand for goods and services is needed to induce inflationary pressures. Again, given that the internal situation influences the level of exports and imports, then external balance will be achieved under specific internal conditions. There seems no reason however to think that these conditions will approximate to those required to satisfy the first two objectives of full employment and a stable currency.

Thus the several internal objectives are not necessarily or readily obtainable concurrently, and the external aims cannot be divorced entirely from internal conditions. However, in the short-run direct controls on imports may be used to enable the concentration of monetary policy on internal objectives, and in the long-run subsidies, tariffs and other means of directing investment may be useful either in expanding output in the fields of export industry or industries producing goods otherwise imported. This sort of policy has received a great deal of attention in Australia.

#### B. Instruments of Monetary Policy

Monetary policy seeks to pursue the objectives as outlined by influencing the level and direction of the demand for goods and services. There are two distinct ways in which monetary policy is aimed at influencing rates of expenditure. One operates through the liquidity of the system and the other operates through interest rates. The two are not always independent in that certain action taken by

the authorities may operate on both liquidity and interest rates. However the two will be discussed separately.

To begin with monetary policy is in the hands of the Reserve Bank and operates primarily through the banking system. The methods used for implementing monetary policy are:

- (1) changes in the ratio of liquid assets and government securities to deposits (the L.G.S. ratio);
- (2) variations in the statutory deposits of the trading banks with the Reserve Bank;
- (3) open-market operations;
- (4) changes in the deposit rates and lending rates of the trading banks;
- (5) qualitative controls relating to the direction of bank advances.

Most of these controls relate to the period since the beginning of the second world war, and any effective controls which were applied before that time under the authority of the central bank became operative less than ten years prior to the second world war, and were much more limited in scope. The measures introduced in the period 1939-1941 have been changed only in degree in the subsequent banking legislation of 1945, 1953 and 1959. Before proceeding with a detailed discussion of these instruments it might be helpful to discuss them in very broad terms.

The L.G.S. convention which has been established in its present form since 1956 requires the trading banks to maintain the ratio of liquid assets and government securities to deposits at or

above some level specified by the Reserve Bank. If any bank allows the ratio to fall below this minimum it must restore the ratio by borrowing from the Reserve Bank at some penal rate of interest. The inclusion of long-term government securities with the liquid assets is unusual but probably justifiable in Australia where the market prices of these securities are kept very stable. The minimum L.G.S. ratio is designed to be used in conjunction with statutory reserve deposits in directly influencing the liquidity of the trading banks.

Statutory deposits were first introduced under this name in the 1959 Banking Act. Previously they were known as special accounts. In fact there has been little significant change other than in name. The Reserve Bank is entitled to call the funds of the trading banks into statutory deposits subject to certain limitations which however, do little to reduce the effectiveness of the device in influencing the liquidity of the banks. For example under the 1959 Act the Reserve Bank must give one day's notice before making fresh calls of funds to statutory deposits. If statutory deposits are in excess of 25% of the total deposits of the trading banks then 45 days notice is required for further calls to statutory deposits.

Open-market operations are concerned with the activities of the authorities in the market for government securities. If the Reserve Bank buys or sells securities in the market then we say it is engaging in open-market operations. In the U.S. and the U.K. the authorities use open-market operations to influence the liquidity of

the private sector. For example if the intention is to reduce the liquidity of the system then the Bank will sell securities thereby withdrawing money from circulation and probably causing a rise in yields and making security holders less willing to sell so that their effective liquidity is reduced. At most times however, open-market operations have played a minor role in Australia as an instrument of monetary policy directed towards liquidity changes. The objective of open-market operations in Australia is instead the stability of security prices at high levels - that is maintaining steady and low market yields. The reasons for not directing open-market operations towards liquidity changes will be discussed later.<sup>2</sup> It will also be seen further on in this chapter<sup>3</sup> that the operations of the authorities in the security market, directed as they are towards price stability, have significant implications for monetary policy.

The rates of interest at which the trading and savings banks borrow and lend are determined by the Reserve Bank. Increases in these rates make it more profitable for the trading banks to expand advances but on the other hand the banks may become more critical of the credit-worthiness of borrowers who are still eager to borrow at higher rates. What we are concerned with is the control of the Reserve Bank over the whole range of lending rates

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2. See pp. 251-254 below.

3. See pp. 248-250 below.

of interest. The Bank has direct control over all bank rates of interest, both the rates at which people lend to the banks and the rates at which the banks lend. However there are many institutions which lend money other than the banks. For instance mortgages, building society loans and hire-purchase finance are available to individuals and businesses from non-bank sources. What we wish to know is to what extent interest rates such as these are subject to the control of the Reserve Bank. Certainly there are no direct controls so the only way in which the Reserve Bank can influence non-bank interest rates is indirectly. In the U.K. the general level of interest rates tends to move with the Bank Rate. However in Australia there is no lending interest rate which is subject to the control of the Reserve Bank equivalent to the Bank Rate. The only possibility is therefore that the Reserve Bank can induce movement in non-bank interest rates by varying the general level of bank interest rates.

Generally the role of the banks, both as borrowers and lenders must have some influence in the capital market. Although the importance of the banks has diminished in relative terms since the war the banks are still the most important single source of funds for borrowers. Therefore the rates of interest offered and charged by the banks must be of some considerable significance in determining the general level of interest rates in the market. Some of the more important connections in the capital market will be mentioned briefly to indicate the manner in which changes in bank

interest rates are likely to be reflected in other market interest rates. Building and investment societies borrow primarily on bank overdraft and invest almost solely in housing loans. Therefore we would expect changes in the overdraft rate to be followed by corresponding changes in the mortgage rate on housing loans offered by the building and investment societies. Savings banks also have a considerable investment in housing loans. Therefore if the borrowing rates of the savings banks rise we would expect some tendency for housing loan rates to rise. A considerable part of the funds of hire purchase companies are provided by trading bank overdrafts although other sources of funds are becoming increasingly important. Consequently increases in the overdraft rate will tend to be reflected in hire purchase interest rates. A considerable part of the funds obtained by companies and of the funds for hire purchase finance is raised through debenture and note issues and from deposits with these companies. The most important contributors are life assurance offices and the public. They could be lending to the banks or purchasing government securities, or in the case of the life assurance offices in housing loans. Therefore we would expect the rates on debentures, notes and deposits to be related to bank interest rates, yields on government securities and rates on housing loans which are themselves likely to be related as seen to bank interest rates.

Other similar instances of the mechanism by which the interest rates of the banking system can influence bank rates could

be given. However the proposition that bank rates do exercise a considerable influence over other interest rates in Australia rests on the assumption of a reasonable degree of perfection in the capital market. If for example loans are freely available from the trading banks at six percent other lenders would find it difficult to lend at a significantly higher rate. In fact bank loans are rarely freely available. The advances of the banks, to suit monetary policy requirements, are often restricted. Due to this market imperfection other lenders can successfully offer loans at a premium. The imperfections introduced into the market by the Reserve Bank's controls over the money supply are likely to lead to considerable differences in bank and non-bank interest rates. If the competition for funds by bank and non-bank institutions is strong an increase in the rate on time deposits of the trading banks will probably be accompanied by a corresponding increase in the borrowing rates of other institutions. On the other hand a fall in the time deposit rate will not necessarily lead to a fall in other borrowing rates. Because the borrowing of non-bank institutions forms a large part of total borrowing these institutions will be concerned not only with their share in total borrowing, but also with total borrowing itself. Only if they expect sufficient funds to be forthcoming at the lower interest rate will non-bank institutions follow the lead of the banks in reducing interest rates. Thus on the lending side the banks may be able to push non-bank rates of interest up when the demand for finance is strong but their ability to pull them down

will be limited to periods when the demand by non-bank institutions for funds is low. Both these potentialities are useful since it is likely that monetary policy will require low interest rates to stimulate borrowing to finance expenditure and when borrowing is at a high level high rates of interest will be required.

The only drawback lies in imperfections in the market. The chief imperfection is the control of the money supply through the banking system by the rationing of loans. The rationing of bank advances enables non-bank lending rates to be significantly higher than bank rates when a restrictive monetary policy is applied. However when the demand for funds is weak and an expansive monetary policy is being applied non-bank interest rates will need to be much more closely allied with bank rates. Another drawback to the effective control of non-bank interest rates by the Reserve Bank is the concern of the authorities with stable security prices coupled with low interest rates. These objectives make the rate of interest on government securities inflexible and to make the control of this rate feasible without extensive open-market operations a reasonable degree of stability of other interest rates and their maintenance at a fairly low level is essential. Therefore the range of movement permitted to the bank rates of interest and the levels to which they can rise are limited and hence the extent to which bank interest rates influence other interest rates is in practice rather limited. Karmel and Brunt<sup>4</sup> comment that "Rates on

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4. Karmel, P. H. and M. Brunt. The Structure of the Australian Economy. 1962. See pp. 130-131.



advances and deposits have been increased from time to time, but these have followed rather than led the market." As an example of this "... the entry onto the capital market of the hire-purchase houses as borrowers offering very high interest rates made public borrowing difficult and forced a rise in interest rates generally." We cannot state with certainty that a rise in bank rates will be accompanied by a general rise in other rates. However it seems probable that a relationship of this type exists. Although historically controlled bank interest rates have tended to be forced up by the high levels of other interest rates, the reluctance to increase bank interest rates may well have brought about a lower level of other interest rates than would have been the case had bank rates been kept in line with market rates at all times. Henderson<sup>5</sup> indicates that the interest rates which are controllable by the Reserve Bank are a significant influence upon the flow of funds in the capital market and therefore on other interest rates by stating that a rise of  $\frac{1}{8}\%$  in security yields above the February 1961 level "... would have reinforced the credit squeeze on the private sector both by forcing up interest rates for long-term borrowing and by directing supplies of investible funds away from the finance of new industrial issues into government bonds." It would appear that

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5. Henderson, R. F. Monetary Policy in Australia 1960/61  
(in Econ. Rec. Vol. 37, No. 79: 294-307, 1961).  
See p. 303.

bank interest rates do exercise some influence on non-bank rates and that the Reserve Bank therefore has some power to control non-bank interest rates indirectly. However, the extent of this influence or the conditions under which it would be effective are not determinate from the brief consideration given to the problem here.

The final instrument of monetary policy to be mentioned is that of qualitative controls. These are controls exercised by the Reserve Bank over the direction of trading banks' advances as distinct from the level of these advances. They are implemented by means of instructions given by the Reserve Bank to the trading banks - instructions which may be couched in general terms or which may be quite specific and detailed. This instrument enables selective restrictions to be applied. For instance the aim of monetary policy at any given time may be the contraction of economic activity via a reduction in liquidity on the one hand while on the other it may be felt desirable that despite this overall contraction particular sectors or industries should be stimulated or at least not inhibited. The technique of qualitative controls enables the fulfilment of a policy of this sort which aims at certain general effects and at the same time wishes to influence the pattern of economic development.

Having looked briefly at the instruments of monetary policy in Australia we will now proceed to a closer examination of them. The first two measures mentioned - a minimum L.G.S. ratio

and statutory deposits - are complementary. Both operate on the liquidity of the economy as a whole entirely through variations in the liquidity of the banking system. The result desired is for the banks to reflect changes in their liquidity in their advances policy. The more frequently used instrument is statutory deposits. However, some liquidity convention is an integral part of policy operating through changes in the level of statutory deposits. Without some conventional minimum L.G.S. ratio changes in statutory deposits would lose much of their effectiveness. For instance, if the conventional minimum L.G.S. ratio is 14% and the actual ratio on the average is 16% then a call of funds to statutory deposits will reduce the banks' margin of liquidity above the minimum and will therefore restrict advances. If, however, the banks had very flexible notions about a minimum L.G.S. ratio, an increase in statutory deposits of the same order would probably not influence the lending policy of the banks to nearly the same degree. The level of advances would tend to be maintained but with a smaller liquidity ratio. In practice statutory reserve deposits and minimum L.G.S. ratios are administered so that, "... if bank lending was in accord with Central Bank credit policy, banks generally would be able to maintain the L.G.S. ratio above the agreed minimum."<sup>6</sup>

We mentioned earlier that the objective of open-market

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6. Coombs, H. C. Conditions of Monetary Policy in Australia. The R. C. Mills Memorial Lecture, University of Sydney, 29th April, 1958.

operations in Australia is the stability of security prices. The reason for open-market operations not being used to alter the liquidity of the private sector is that such action would cause large fluctuations in market yields. Large variations in interest rates are regarded by the authorities as undesirable for economic growth. It is maintained that stability in long-term interest rates at reasonably low levels will encourage investment in the desired direction since not only is the cost of funds for investment fairly low but also the stability of rates provides a considerable degree of certainty for schemes which involve planning and development over a long period of years. Also severe fluctuations in security prices may involve complications for financial institutions in arranging their portfolios and may discourage them from holding securities. The same might apply to those individuals who are placed in the position of having to realise capital losses on their security holdings. The concern of the authorities for price stability is particularly restricting in Australia due to the narrowness of the market for government securities. The transactions of individuals in the market are relatively small, and their buying is concentrated on new loans, and of the institutional holders of securities probably a majority such as insurance companies, tend to hold securities to maturity. Thus under normal circumstances the volume of trading on the market is limited. As a result buying or selling by the Reserve Bank on a significant scale will tend to result in large price movements, particularly if corresponding monetary policies are being applied in other fields. For instance

if a general reduction in liquidity is the aim through various policy measures, then there will already be some selling pressure in the securities market by people and institutions seeking to restore the level of their money holdings. Any open-market sales by the Reserve Bank aimed at reducing liquidity will further add to the general selling pressure on the market. However the narrowness of the security market is not itself enough to prevent the successful use of open-market operations directed towards changes in the liquidity of the private sector. If the authorities were prepared to ignore the stability of security prices, the narrowness of the market would not entirely inhibit open-market operations. The point is well made by Arndt:<sup>7</sup> "In a market in which the volume of ordinary transactions is as small as it has generally been in Australia, the central bank cannot greatly influence the liquidity of the trading banks by open market purchases or sales of bonds without unsettling yields. The interest of the Treasury in a stable and low bond rate has set particularly narrow limits to the use of open market sales as part of a restrictive monetary policy."

The joint aims of price stability and low interest rates not only make open-market operations ineffective as an instrument of monetary policy under most circumstances, but may often result in action which weakens the effectiveness of other monetary policy

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7. Arndt, H. W. The Australian Trading Banks. p. 216.

measures. The Reserve Bank may for example be forced to buy securities in order to maintain the level of prices, and thereby increasing the volume of money, even while other policies are seeking the reverse - to reduce the volume of money and liquidity generally.<sup>8</sup>

The borrowing and lending rates of the trading banks are fixed by the Reserve Bank with an eye on the long-run objectives of monetary policy. Changes in the rates are infrequent indicating its limited use as a short-run measure. The intention for the post-war period has been to keep interest rates generally low in correspondence with the low yields maintained on securities to meet the needs of long-run economic development. The viewpoint seems to have been held for much of the period that the rate of interest is not particularly useful in regulating economic fluctuations<sup>9</sup> and that the primary need is to keep interest rates at a low and fairly stable level in order to facilitate long-range planning and development in different fields of investment. However, in recent years there seems to have been a shift in attitudes. There is now some

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8. This has in fact occurred on a number of occasions as for instance in 1954/55. While the objectives of price stability and low yields may be considered reasonable in themselves, as is pointed out by Dr. H. C. Coombs, p. 26 "from time to time they involve the Central Bank in unpleasant dilemmas and can inhibit the prompt performance of its primary functions."

9. Giblin, L. F. The Growth of a Central Bank. "It was doubtful if variations of interest-rates could be a powerful instrument for controlling booms and depressions." p. 339.

recognition that the rate of interest may be useful as a short-run regulator, and it is conceded that although generally low interest rates are to be favoured in the interests of long-run developments, there are times when substantial increases in interest rates may be warranted.<sup>10</sup>

Next to statutory deposits the most important of the controls exercised by the Reserve Bank over the trading banks is qualitative control over their advances. Up until 1952 this control was used often, and in detailed form. Since 1955 the directions of the Reserve Bank have been in more general terms. Qualitative controls enable a restrictive policy to be applied to the economy as a whole, but permit certain sectors to be restricted to a greater degree and others to a lesser degree as the need may be. Thus qualitative controls can be used not only to reinforce the influence of quantitative controls but also to influence economic conditions in particular industries and areas and hence the pattern of development. For instance the directive of May 1952 to the trading banks stated that banks should "... continue their efforts to direct credit only to essential purposes and, in particular, ensure the highest priority for essential production and exports."<sup>11</sup> Again in

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10. Coombs, H. C. Conditions of Monetary Policy in Australia.

"Experience since the war suggests that in our pursuit of persistently high levels of employment and business activity we are likely from time to time to be faced with active or potential inflation which can be checked or controlled only by measures which involve the acceptance of a rise in interest rates - particularly on Government bonds." p. 27.

11. The quotation is taken from Arndt, H. W. The Australian Trading Banks. See p. 207. As its source Arndt acknowledges the Australian Financial Review, 29th May, 1952.

1960/61 in a period of general credit restriction, qualitative controls were designed to enable the expansion, amongst others, of export industries.

### C. The Influence of Policy Measures

We have seen that the instruments of monetary policy used in Australia are of two types. These are interest rate variations and measures designed to influence the liquidity of the economy. The object of the present section is to consider the ways in which each of these two types of instrument influences spending plans. We will consider them in turn.

One way in which interest rate changes affect the level of spending is by affecting the profitability of investment in fixed capital equipment. An example used by Shackle<sup>12</sup> illustrates the role of the rate of interest. If the initial cost of a machine is 100 units and net earnings expected from it are 40 units per year for three years and nothing for subsequent years, the marginal efficiency of capital is 10% per annum. In this case it will not pay to invest in this machine if an interest rate of more than 10% has to be paid on borrowed funds. However there is a considerable area of uncertainty associated with most investment plans. "By contrast with these uncertainties the powerlessness of interest rates, within the ordinary range of 2-8% per annum, to influence the demand price of near horizon equipment by undergoing

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12. Shackle, G. L. S. Recent Theories Concerning the Nature and Role of Interest (in Econ. J. Vol. 121, No. 282: 209-254, 1961). p. 248.



any change of a size which may be supposed to occur within months is a matter of plain arithmetic."<sup>13</sup> If the expected profit of the third year is 20 units and we discount this profit to obtain its present value using a rate of interest of 4% and then of 5% the present value of the expected profit is 17.8 units in the case of the 4% rate of interest and 17.2 units in the other case. Thus in this example a change in the rate of interest of one percent which is quite a significant change makes little difference to the present value of expected profits of the immediate future. Changes in the rate of interest of this nature will be more significant only over much longer time periods. Probably for many investment decisions the time period considered is relatively short. Interest rate changes are relevant to decisions relating to longer periods such as investment in buildings. For many other forms of investment the uncertain yields associated with them and the attendant risks probably mean that the rate of interest is a factor of little significance. Likewise changes in the rate of interest probably have only a marginal effect on the level of investment in stocks unless individual stocks of goods are unduly large, since a basic volume of stocks is required by any business to allow for irregularities in the flows of goods. But even if certain forms of investment are sensitive to the level of interest rates, there remains the very practical problem of time lags. There are

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13. Recent Theories Concerning the Nature of Interest. p. 248.

several sources of time lags and they apply generally to monetary policy measures whether these take the form of interest rate variations or some other form. Therefore at this stage we will consider all of the more important sources of such lags not simply those lags relating specifically to interest rate changes. There may be time lags in both the enforcement of monetary policy and in the reaction of businesses and individuals to it. The time lag in enforcement is the delay of the banks in instituting the policy desired by the Reserve Bank. The enforcement lag relates to the banking system. It is referred to by Henderson<sup>14</sup> as the "banker's lag" and it stems from the reluctance of banks to restrict their good customers. Thus the banks probably hope to meet the requirements of the Reserve Bank by the restriction of new lending rather than by reducing existing overdrafts. Henderson comments<sup>15</sup> that "... when a reduction in bank advances is achieved mainly by reduction in the rate of new lending this is bound to take several months." Once the full force of monetary policy is being felt through the banks there are a number of factors which are likely to result in some considerable delay in the response of the private sector. One such factor is the time interval between the ordering of imported goods and the receipt of these goods. To the extent that this interval exists there will be a time lag in the reaction

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14. Monetary Policy in Australia 1960/61.

15. Monetary Policy in Australia 1960/61. See p. 300.

of the flow of imported goods to monetary policy measures. It is suggested by Henderson<sup>16</sup> that the time lag in the case of imports of finished goods is six to nine months, while for raw materials and semi-finished goods the lag is about three months. There are similar sorts of lags for home produced goods although generally the lags would be expected to be shorter and in many cases industry is not producing to order. Another factor which influences the interval between the implementation of monetary policy and the response of the private sector to it lies in the nature of investment in fixed capital equipment. Because of the extensive planning involved in many investment projects, the time required for the submission and examination of tenders and the long periods often required for the completion of these projects it seems unlikely that monetary policy measures will have significant immediate effects on such projects. What is more likely is that some new investment projects may be held in abeyance, but with existing projects being completed the effect of the monetary policy measures would not become evident for some time. A final source of time lags is trade credit. When restrictive monetary measures are applied trade credit may tend to expand. The shortage of funds brought about by a restrictive monetary policy may lead to a general extension of credit between firms. Such a reaction will postpone the full effects of any given policy measures. Firms

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16. Monetary Policy in Australia 1960/61. See p. 299.

buying goods will do so in the knowledge that they have an extra thirty days (for example) to find the funds to make payment and therefore their buying will not be immediately subject to the full impact of the restrictive policy measures.

There are thus a number of sources of time lags in the reaction of the level of demand for goods and services to the application of monetary policy measures. As one policy measure interest rate variations will be subject to these time lags and to this extent their immediate influence will be weakened. In particular the long time lags likely in the response of investment in fixed capital equipment to interest rate changes implies that at least in this field the rate of interest is not very useful as an instrument for the control of economic fluctuations which require action which will take immediate effect.

A second avenue through which the rate of interest may operate is the demand for durable consumer goods. If as seems likely from the discussion earlier,<sup>17</sup> a rise in bank rates of interest is reflected in rates charged on consumer credit the rise in these rates may lead to a reduced demand for consumer durables. There is considerable doubt whether the demand for consumer durables is responsive to changes in the cost of borrowing. However we can say that if the demand is responsive the lag between an increase in interest rates and the subsequent reduction in spending on durable

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17. See pp. 244-250 above.

consumer goods should be much shorter than in the case of expenditure on fixed capital equipment.

A third way in which an increase in the rate of interest may affect the level of spending is by reducing the liquidity of the system and so restricting the rate of spending by individuals on consumer durables and by firms on fixed capital equipment and inventory accumulation. This is the so-called availability effect discussed at length by the Radcliffe Committee.<sup>18</sup> If the borrowing and lending rates of the trading banks are increased the liquidity effect relies upon other interest rates moving correspondingly. If in fact other yields and rates of interest do tend to increase,<sup>19</sup> the associated fall in the capital values of assets will make people less willing to realise these assets to finance current expenditure than formerly. The manner in which interest rate changes affect the liquidity position of the individual has been illustrated in earlier chapters and there is no need to repeat the argument here. The point to be made is that for changes in bank rates of interest to have this liquidity effect, other interest rates must move correspondingly and the market prices of assets must move inversely. The asset which is likely to be regarded as most liquid other than money and which is therefore most influential in determining the liquidity position of the individual is government securities. However, as

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18. The Report of the Radcliffe Committee is considered in the first chapter and the availability effect is discussed there.  
See pp. 16-18 above.

19. See pp. 244-250 above.

has been indicated the variations in the market prices of securities are strictly limited in Australia and therefore government securities remain highly liquid under most circumstances. Therefore, because of the price stability sought after in the market for securities the effectiveness of changes in bank rates of interest in causing changes in the liquidity of the economy as a whole is limited.

The measures of monetary policy other than variations in interest rates are designed to have an availability effect. The availability effect is virtually the difficulty involved in raising funds due to the immobilisation of liquid assets - in the case of money by removing it from the system, and in the case of assets by rendering them less liquid. The Reserve Bank confines its operations to the banking system, on the basis that the banks are the primary source of funds, and if a change in the liquidity of the banks causes the appropriate changes in their willingness to lend, then the change will be reflected throughout the economy. Thus the operation of statutory deposits together with the minimum L.G.S. ratio seeks to vary the liquidity of the banking system directly and the liquidity of the economy as a whole indirectly. The qualitative controls have the same sort of effect, but one which is confined to particular industries or sectors. The availability of bank advances is not limited or expanded for the whole economy by qualitative controls.

The effectiveness of measures operating through the availability effect will depend upon the relative importance of

institutions other than the banks which are sources of funds and the extent to which the direct control over the banking system gives the Reserve Bank indirect control over the activities of these non-bank lending institutions. It must also be noted that some of the time lags mentioned earlier<sup>20</sup> apply to these measures which operate through the availability effect. For example the time lags resulting from the interval between the ordering and the receipt of goods and from changes in trade credit are relevant to measures designed to operate through the availability effect.

The measures of control which have been discussed are used particularly to offset short-run fluctuations in the economy, including the effects of changes in the balance of payments, and are also directed towards the moulding of long-term development both in general expansion and stability and also in the pattern of development. Fluctuations resulting from internal seasonal influences have been largely ignored in the field of monetary policy being left to the direction of the trading banks.<sup>21</sup> The effectiveness of

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20. See pp. 257-260 above.

21. Memorandum of Evidence Submitted by the Governor of the Commonwealth Bank of Australia. Committee on the Working of the Monetary System: Principal Memoranda of Evidence, Vol. 1. London, HMSO, 1960. See p. 248, para. 45.

"Under current Special Account administration, the individual banks are left with the responsibility for judging the impact of the very variable Australian seasonal movements on their own figures." Thus the trading banks where liquidity is high for seasonal reasons must be wary of running down their liquidity too far, because of the subsequent anticipated seasonal reduction in liquidity. Since late 1959 the issue of Seasonal Treasury Notes for the period November to March by draining off excess liquidity during this period offsets to some degree effects of seasonal fluctuations in liquidity.

interest rates in particular and also of the other measures of monetary policy as methods of implementing short-run controls on the level of demand for goods and services must be subject to some doubt due to the delays which arise from the various sources of time lags.

#### D. Some Problems Faced by Monetary Policy

A number of difficulties arise in the application of monetary policy in Australia and in this section some of the more important problems will be briefly considered.

The market for securities in Australia is a very narrow one, and this factor coupled with the "cheap-money" policy which has been followed in the post-war period has rendered the task of satisfactorily incorporating open-market operations in overall monetary policy virtually impossible. Narrowness of the market leads to difficulties when the aim of policy is to restrain spending by reducing the money supply, although if the aim is to expand the money supply the same problem does not exist. In the case of the U.S. or the U.K. the required reduction of the money supply could be obtained by sales of securities on the part of the monetary authorities. However, in Australia sales on a scale sufficient to reduce the quantity of money significantly would result in a "flooding" of the market and the consequent fall in price or rise in the yield on securities would be regarded as undesirable, firstly because of the instability created in the market and secondly because a high yield is inconsistent with the general policy of cheap interest rates. In the case of the



November 1960 measures the limitations of the security market were overcome temporarily by enforcing certain financial institutions to hold a minimum percentage of their assets in the form of securities. However, such action does not provide a long-run solution to the problems associated with open-market operations. The Reserve Bank has therefore been forced to use direct controls over the banking system as the main weapon for controlling the money supply. Not only can open-market operations generally not be used in support of monetary policy but often the action which is taken in the security market to maintain the price of securities tends to offset the monetary policy being enforced by other measures. Instances of this are given by Arndt:<sup>22</sup> "... both in 1951 and 1955, reluctance to abandon cheap money in the face of strong selling pressure in the market compelled the central bank to operate in the wrong direction: buy to sustain bond prices when it should have sold to reinforce its credit restrictions."

Another problem of monetary policy lies in institutional change. One of the most marked institutional changes in Australia in the post-war years has been the increase in the number and diversity of financial intermediaries. This means that the banking system has a relatively less important role to play in the financing of the economy than before the war and that monetary policy which works entirely through the banking system is working in a contracting field.

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22. The Australian Trading Banks. See p. 217.

Moreover the problem can be expected to become steadily more acute should inflationary conditions become more or less the general rule. In this event monetary restrictions will also become the general rule and the effect of this will be to encourage the expansion of non-bank financial intermediaries at the expense of the banks. Thus the field in which monetary policy operates will contract still further: the very use of monetary policy will make its instruments steadily less effective. The more the role of the banks' is usurped by other institutions, the less effective will be measures directed through the banks, and the less certain the effects of any given measures. The solution of course would be for Reserve Bank controls to embrace all financial institutions. However, there are constitutional difficulties in such action. The obvious limitations of monetary policy would be less marked if the Reserve Bank were able to operate directly on the liquidity of the public and of non-bank institutions by means of open-market operations. If this were so then credit restrictions through the banks could be supplemented by sales of securities by the Reserve Bank in order to reduce the money holdings of the public directly and to increase the yield on bonds and thereby to render them less liquid. In fact as we have seen open-market operations do not have a great deal of meaning in Australia. Therefore the limitations involved in the restriction of monetary policy to controls relating to the banking system are supplemented and magnified by the ineffectiveness of open-market operations.

Finally there appears to be a significant lapse of time before the banking system reacts to the actions of the Reserve Bank. When the Reserve Bank adopts certain measures to restrain bank lending the response of advances is in fact often very slow. One of the main factors is the operation of an overdraft system of bank lending coupled with the branch banking system. The branch banking system means that there is inevitably some delay before directives filter through and become fully effective in the various branches. This has already been considered in the discussion of time lags<sup>23</sup> and is referred to by Henderson who relates the case of one bank customer who delayed reducing his overdraft for three to four months after the announcement of the credit restrictions of November 1960. Henderson comments that "... possibly the bank hoped it would get by without forcing his overdraft down, and only did so late in the day."<sup>24</sup> If this sort of attitude applies to all "... large and good ..." customers of the banks the implications for the effectiveness of monetary policy may be considerable. Also of importance in delays in the effective application of policy measures is the influence of unused advance limits. For a variety of reasons many recipients of bank advances at any one time will not be using these to the limits specified. When restrictions are applied by the Reserve Bank to the trading banks, the latter will reduce to whatever degree is required the level of new advances granted. However, the substantial undrawn

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23. See pp. 257-260 above.

24. Monetary Policy in Australia 1960/61. See p. 300.

advances will be a source of funds to the borrowers concerned for some time after the restriction and in many cases their rates of expenditure may be impeded very little by the availability of funds. Thus the system of bank advances used in Australia results in a cushioning of the monetary policy measures of the Reserve Bank and is another factor making these measures less precise and predictable in their results.

A number of factors limiting monetary policy in Australia have been mentioned. The last one mentioned delays in the application of monetary measures and could be overcome to a considerable extent by changes in the system of lending and in some way bringing about a closer communion between the banks' management at the head office level and at the branch level. The objective of open-market operations of price stability coupled with the narrowness of the market for securities considerably impairs the operation of monetary policy in restraining the demand for goods and services. Finally limitations are imposed on monetary policy because it operates within the limited field of the banking system which also tends to be a relatively less important source of funds for the private sector when inflationary conditions persist over considerable time periods.

#### E. Implications of the Empirical Analysis for Monetary Policy

In the light of the foregoing discussion it would appear that monetary policy in Australia consists of attempts on the part

of the Reserve Bank to influence the rate of aggregate spending by manipulating the quantity of money rather than liquidity in general through variations in the liquidity of the trading banks. Thus for Australia an important question is: how much does the money supply have to be reduced in order to achieve any given reduction in the rate of spending? The answers given to this question in the past must have been based on little more than guesswork, the only real basis for the guesswork being a fairly limited previous experience. With a demand-for-money function we ought to be able to do better than this; if we really have found a stable function for Australia in chapter five we should be able to use it to make more informed guesses about the reduction in the money supply required in any given circumstances to achieve some desired change in the level of spending. Several examples will serve to illustrate this. The regression for the 1945-46 to 1960-61 period with the estimated parameters is:<sup>25</sup>

$$M = 7.97 + 0.128Y - 2.002r + 0.405D + 0.167P' + 0.174E' \quad (1)$$

where M is the quantity of money per capita, Y is the level of income per capita, r is the yield on government securities, D is outstanding government debt per capita, P' is the rate of change of retail prices and E' is the rate of change of share prices. The series used for M, Y and D are all deflated using the retail price index. From what has been said earlier about open-market operations we can take it that for Australia r is a parameter: at any time

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25. See p. 207 above.

the authorities can supply a figure for  $r$  since it is a managed rate of interest. Similarly  $D$  is a parameter and a figure can be substituted for it also. If we assume conditions of price stability both for retail prices and share prices figures can be supplied for  $E^1$  and  $P^1$  and we then have a relationship between only the two variables  $M$  and  $Y$ . Since  $M$  is controllable we can use this relationship to obtain the change in  $M$  required to yield the desired change in  $Y$  in real terms.

As an example suppose that in the year 0 we wish to know what reduction in the stock of money will be required to achieve a given reduction in the level of spending in the year 1. Suppose further that retail and share prices are expected to remain constant and that no change is contemplated in either  $D$  or  $r$  then we can estimate from a simple relationship between  $\Delta M$  and  $\Delta Y$  what change in  $M$  is required to produce the desired change in  $Y$ . The relationship is:

$$\Delta M = 0.128 \Delta Y^{26}$$

If desired real income per capita is £500 and current real income per capita is £400 then  $\Delta Y = £100$ . Thus:

$$\begin{aligned} \Delta M &= 0.128 \times 100 \\ &= £12.8 \text{ per capita} \end{aligned}$$

Hence the increase required in the money supply for an increase in the level of real income per capita of £100 is £12.8 per capita.

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26.  $\Delta D$ ,  $\Delta r$ ,  $\Delta P^1$  and  $\Delta E^1$  are all zero.

Another example may be useful. Assuming again that  $r$  and  $D$  are to remain constant, that both retail and share prices are currently constant but are expected to rise by 2% per annum and that the desired increase in real income per capita is again £100 then the increase in  $M$  required to yield the desired increase in real income is given by:<sup>27</sup>

$$\begin{aligned}\Delta M &= 0.128\Delta Y + 0.167\Delta P' + 0.174\Delta E' \\ &= 0.128 \times 100 + 0.167 \times 2 + 0.174 \times 2 \\ \Delta M &= 13.482 \text{ in constant prices} \\ &= 13.482 \times 1.02 \text{ in current prices.}\end{aligned}$$

Thus because of the expected change in prices the required change in the quantity of money to product the same affects on real income per capita is slightly greater than in the first example.

In practice the regression would not provide results with the precision indicated by the example. We shall return to this point shortly. However the regression at least enables us to obtain some idea of the degree of reduction or expansion of the money supply required to achieve some specific change in the level of real income.

27. The values for  $\Delta P'$  and  $\Delta E'$  are both 2. The change in  $P'$  is given by:  $\frac{P_1}{P_0} \times 100 - \frac{P_0}{P_{-1}} \times 100$ .

Since prices in year 0 are constant  $\frac{P_0}{P_{-1}} = 1$  and by assumption also  $\frac{P_1}{P_0} = \frac{102}{100}$ .

$$\begin{aligned}\text{Therefore } \Delta P' &= \frac{102}{100} \times 100 - 1 \times 100 \\ &= 2\end{aligned}$$

Similarly  $\Delta E' = 2$ .

There would still be the problem of effecting the indicated change. As mentioned earlier<sup>28</sup> there will usually be delays in the response of the banks to action taken by the Reserve Bank and other factors which make it difficult for the Reserve Bank to achieve desired changes in the quantity of money quickly or accurately. However these difficulties exist whether or not the authorities seek a greater precision in the application of monetary measures by the use of an econometric relationship such as the one we have developed.

Another possibility in the field of empirical work for monetary policy lies in interest rates. If the policy of keeping the yield on government securities relatively constant by means of open-market operations were abandoned and the authorities were to use open-market operations to bring about variations in the rate of interest designed to influence expenditure then we could make good use of a function with the yield on securities as the dependent variable instead of the quantity of money. We could use such a function in a manner similar to that described in the two examples just discussed to see what change in the yield on securities would be associated with any given desired change in real income. For example one of the regressions fitted by Turvey<sup>29</sup> is:

$$I = 1.41 - 0.032 \frac{N}{P} \times 100 + 0.024 \frac{FO + G}{P} - 0.048 \frac{LTD + G}{P} + 0.016 \frac{Y}{P} \\ \times 100 + 0.13T \quad \dots \quad \dots \quad \dots \quad (2)$$

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28. See above pp. 257-260.

29. Turvey, R. Interest Rates and Asset Prices. 1960.



where  $I$  is the average yield to maturity on federal obligations held by the private sector,  $N$  is the quantity of money with adjustments for savings bonds and bank loans outstanding,  $FO$  is the quantity of federal obligations outstanding,  $LTD$  is the monetary sector's holding of long-term debt,  $Y$  is national income,  $T$  is the rate of turnover of bank deposits and  $P$  is a price index. From this regression Turvey provides an illustration. The prediction he makes<sup>30</sup> at the end of the third quarter of 1954 for the following quarter assumes explicitly a ten percent increase in prices and transactions and assumes implicitly that the quantity of money, federal obligations outstanding and long-term debt all remain constant. The conclusion then drawn is that an increase in the yield on federal obligations of 0.89 would be accompanied by an increase in money income of ten percent. Thus if the authorities were seeking to bring about such an increase in money income by means of interest rate changes, given the assumptions about the future values of the other explanatory variables, the estimate made by Turvey from the regression (2) above provides some indication of the degree of intervention required of the authorities.

It can be seen that empirical investigations of the demand-for-money function could yield results making monetary policy in Australia a more effective tool. Whether or not it will do so depends on whether the function found is a useful predictive tool.

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30. Interest Rates and Asset Prices. See p. 77.

The multiple correlation coefficients are high for all three estimates made in chapter five above. However although this is a necessary condition for a function to be stable it is not a sufficient condition. In a recent article which considers the problem of assessing the usefulness of econometric relationships for predictive purposes Shupack<sup>31</sup> maintains that if the derived function provides stable and accurate predictions a useful tool has been derived. The only way to be sure that the econometric relationship is a more useful predictive tool than some other which could be used is to use both to make predictions over a long period and to find out which gives the more satisfactory results. This raises the problem of how we tell whether any given function performs more satisfactorily than its rivals. Shupack deals with this problem by presenting a number of criteria which may be used to assess the usefulness of different methods of prediction, both absolutely and relative to each other. One criterion used by Shupack is the frequency with which predictions from each of the various function are closest to the actual values. The method which will satisfy this criterion is the one which comes closest to predicting the actual value for each year of the study more often than any of the other methods used. Another criterion suggested is that of average rank. The methods are ranked for each prediction and the method with the highest average rank for the period of

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31. Shupack, M. B. The Predictive Accuracy of Empirical Demand Analysis (in Econ. J. Vol. 122, No. 287: 550-575, 1962).

years for which the test is made satisfies the criterion. The use of this criterion eliminates any risk of the choice as the best method one which provides the closest predictions for a greater number of years than any other method but which may perform poorly relative to other methods for the remaining years. A number of other criteria are suggested. One for example ranks the methods according to their ability to predict turning points in time series of actual data. Each of the possible criteria measures a different aspect of the relative ability to predict accurately. Shupack points out that it is difficult to know which of these criteria to rely on most heavily. However in his own application of the criteria Shupack finds that "Although each of the criteria proposes to measure a somewhat different aspect of the closeness of predictions and the actual values, the relative goodness of the various methods seems to change little with a change in criterion. A method which appears better than other methods under one criterion retains its superiority for most of the criteria used."<sup>32</sup> No one criterion stands out as superior to the others as a measure of the goodness of different predictive methods and Shupack suggests that there is considerable scope in this field to find more suitable and satisfactory criteria than those which he presents.

In this thesis no attempt has been made to assess the value of the regressions developed in this thesis as predictive

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32. The Predictive Accuracy of Empirical Demand Analysis.  
See p. 555.

tools by means of tests such as these. Estimates of actual values have not been made and compared with actual values for the regressions fitted in this analysis or for any other method of prediction. Therefore little can be said about the usefulness of the regressions as predictive instruments. All that can be said on the basis of the work done is that it would certainly be useful to extend analysis in the direction suggested by Shupack in order to see whether a truly satisfactory method of prediction could be established.

## CHAPTER SEVEN

### CONCLUSION

In the preceding chapters we have attempted to outline and discuss some aspects of monetary theory, to survey a number of empirical analyses of the demand for money which have been undertaken for other countries, to conduct an empirical investigation of the same type for Australia and finally to consider the implications of the Australian investigation for monetary policy in this country. In this final chapter we shall try to highlight some of the main points which have emerged in earlier chapters and to draw attention to some of the possibilities for further work which they reveal.

#### A. Why is a Demand-for-Money Function of Interest?

Since the demand-for-money function forms the basis of the whole study this question is fundamental. It has been dealt with in detail in chapter one and has also been referred to in subsequent chapters. Several reasons for an interest in the demand-for-money function have been suggested there.

In the first place if the rate of interest varies with changes in the demand for or supply of money, as there are good a priori reasons to believe,<sup>1</sup> information about the demand-for-

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1. See chapter two above.

money function will yield a more precise knowledge of the changes in the stock of money or in the demand for money required to produce any given change in the rate of interest. A knowledge of the function enables us to manipulate the rate of interest by varying the quantity of money and the better the knowledge of the function the better we are able to estimate the changes required in the quantity of money in order to bring about any required changes in the rate of interest. Thus the function can be used to assist in the application of monetary policy measures designed to influence the rate of interest.

Why do we wish to influence the rate of interest? The main reason is that if we can control the interest rate we can influence the level of aggregate spending. There are two possible ways in which interest rate variations can influence the level of spending. One is by causing variations in the desired level of investment spending and the desired level of consumer-durable spending. This is the so-called interest-incentive effect which has a long history and which forms one of the key propositions of the Keynesian model.<sup>2</sup> The importance of the interest-incentive effect has been frequently questioned in recent years, for instance by the Radcliffe Committee,<sup>3</sup> and is often regarded as important only in relation to long-term investment plans. The conclusions of many such as those conclusions

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2. The model is reproduced earlier: p. 53 above.

3. The Report of the Committee on the working of the Monetary System (cmd. 827) London, H.M.S.O. 1959.

which are embodied in the report of the Radcliffe Committee, more or less dismiss changes in the rate of interest as of little importance in bringing about changes in expenditure by means of an incentive effect as a method of controlling short-run fluctuations in the level of economic activity.

Another possible way in which interest rate variations can influence the level of spending is in causing variations in the availability of funds required to carry out the desired level of investment spending. This is the so-called availability effect considered in detail earlier in this thesis.<sup>4</sup> Firms which are planning investment projects and individuals who are planning the purchase of consumer durables will rely for funds on the liquidation of assets which they themselves own or on borrowing. If when the time arrives for the assets to be sold their price has fallen but is expected to rise again at some future date, the asset-holders will be less inclined to sell their assets because by doing so they will incur a capital loss which they could avoid by retaining the asset until the expected price rise occurs. In this way changes in the rate of interest may influence the availability of funds for investment and consumer-durable spending. In the case of the individual selling his own assets the effect of a price fall is a real one but it might be argued that the availability effect in this form is simply the interest-incentive

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4. See pp. 17-18 above.

effect in another guise. In reply to this it is a reasonable proposition that many people show a marked aversion to realising capital losses and that they do not interpret a capital loss as simply a reduction of the rate of return on the asset involved. In the case of lending institutions the effect of a fall in the price of assets does not appear to be a real one as these institutions will simply raise their lending rates of interest sufficiently to offset any capital losses which would be incurred by selling assets. Therefore it would appear that the availability effect does not operate through institutions. However in fact there is a considerable degree of rigidity in institutional lending rates and so the institutions are unable to increase the rates of interest at which they lend without a considerable time lag. Thus within the period of the time lag institutions will be reluctant to lend as capital losses will be realised without any compensating increase in the interest rates on loans.

The availability effect on the level of spending may operate not only through interest rate changes, but also through changes in the quantity of money and other liquid assets, although the Radcliffe Committee appears to favour interest rate changes as the most important instrument of monetary policy. However, changes in the quantity of money as well as the quantity of other liquid assets must be significant since if they are reduced, it is less likely that in any given situation funds will be available



to a would-be borrower. The difference between the interest-incentive effect and the availability effect, is primarily that in the case of the interest-incentive, interest rates operate on spenders, while in the case of the availability effect interest rates operate initially upon lenders. Furthermore, it is change in interest rates which is important to the availability effect, whereas for the interest-incentive it is the absolute level which is more important. The interest incentive is a "cost" effect operating on the borrower, while the availability effect relies upon market imperfections and uncertainty regarding interest rates, with the added possibility that some people and institutions are sensitive to realising capital losses. One involves the abstinence from spending on grounds of cost; the other, because funds are simply not available - the financial institutions ration funds. Thus the demand-for-money function derives importance from the propositions that the rate of interest and the quantity of money are related through this function and that the rate of interest and the level of spending are also related, either through the interest-incentive effect or the availability effect. As has been illustrated in the previous chapter<sup>5</sup> if we have a stable relationship between the quantity of money, the level of income and the rate of interest, we can use this to obtain some idea of what changes in the quantity of money and the rate of interest will result in given changes in the level of

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5. See pp. 269-273 above.

income. This is one important reason justifying the investigation of the nature of the demand-for-money function.

A second justification for an interest in the demand-for-money function is that such a function may prove useful in completing aggregative econometric models<sup>6</sup> and has in fact done so in recent years. Thus even if it is not of direct interest the demand-for-money function may nevertheless prove to be valuable in facilitating studies in other fields of economics.

We have seen earlier<sup>7</sup> that both changes in monetary policy and in the reaction to those changes are subject to the influence of time lags. The implications of these time lags are considerable. Another justification for empirical analysis is that it might well reveal time lags which are such that monetary policy is virtually useless as a means of short-run control. A greater knowledge of the demand-for-money function would shed some light on the nature and extent of these time lags.

#### B. How Has the Theory of Money Developed Since Keynes?

The Keynesian demand-for-money function has been discussed in chapter two. Keynes was concerned with developing a flexible relationship between the quantity of money and the level of income as a meaningful relationship. He does this by introducing the bond rate of interest as a factor giving

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6. This point is discussed in chapter one, pp. 3-5.

7. See pp. 258-260 above.

rise to a demand for money over and above the transactions requirements as determined by the level of income. This relationship together with the other relationships of his model imply that we can bring about changes in the level of income by varying the rate of interest or the quantity of money or both. In the period since the publication of *The General Theory* there has been a continual search for a more complete knowledge of the demand-for-money function, inspired to a considerable extent by the often unsatisfactory results of empirical investigations of the simple Keynesian relationship. It became clear from empirical studies that the variables income and interest rate did not provide a satisfactory explanation of desired money holdings. There were two alternatives: either to discard the notion of a demand-for-money function as a useful tool of economic analysis or to attempt to improve the function. The latter alternative was the one chosen. By and large efforts to improve the function have taken the form of introducing additional explanatory variables selected from those variables which appear likely on a priori grounds to influence desired money holdings. Among the variables introduced the most important have been: the volume of other liquid assets and their price level, the price level of non-liquid assets, the volume of total assets and the rate of change of commodity prices. The influence of tastes and expectations is considered, but generally, these variables cannot be incorporated specifically

in empirical analyses. Although Keynes' function is modified on occasion almost beyond recognition, the underlying idea remains the same - that a stable demand-for-money function exists and that a knowledge of it will clarify the relationship between the quantity of money and the level of income and so make possible a more effective control of aggregate economic activity by means of monetary policy.

C. How Have These Developments Influenced Empirical Research?

Many attempts have been made over the last two decades to estimate demand-for-money functions for the private sector as a whole and for a number of sub-sectors of the private sector, particularly in the U.S. and the U.K. In general they have been based on the Keynesian theory at different stages of its development. The earliest studies were based on the simple Keynesian relationship of the quantity of money, income and interest rates while more recent studies have tended to reflect the various post-Keynesian theoretical developments.

The discussion of chapter four has shown that there is considerable justification on empirical grounds for the extension of the Keynesian demand-for-money function and that many of the modifications made have received strong support. In particular, the inclusion of total assets as an explanatory variable has received strong support on empirical grounds. The outstanding conclusion to be drawn from an examination of the empirical analyses as a whole is that a more stable function than that

suggested by Keynes can be arrived at by the inclusion of a comparatively small number of explanatory variables. Even where the explanatory variables have not been statistically significant, almost without exception the direction of the relationship between these variables and the dependent variable is in accord with a priori expectations.

D. To What Extent Do the Results of the Empirical Investigation For Australia Confirm the Results of Other Analyses?

In chapter five we have tried to establish a demand-for-money function for the Australian economy. The approach adopted, both as regards the form of the function fitted and the explanatory variables chosen was influenced by the theoretical propositions discussed in earlier chapters and by the empirical analyses for other countries discussed in chapter four.

The empirical work presented in chapter five is very limited and so therefore are the conclusions to be drawn from it. The relationship between the level of money income and the quantity of money is a direct one as is also the relationships between the quantity of money and outstanding government debt. These results are consistent with a priori conclusions and with the results of other analyses. For the rate of change of prices an unexpected result is obtained. The direct relationship found between this variable and the quantity of money, is the reverse of what we would expect in the light of a priori conclusion and the results of other analyses. One striking result emerging is the low

apparent correlation between desired money holdings and the yield on government securities. This contrasts with Keynes' reliance on it as the only explanatory variable other than money income but is in line with the results obtained by many other analyses. Generally the question of the importance of the rate of interest appears to be still a largely unsettled issue. Some analyses find the rate of interest to be of little importance in explaining changes in the demand for money while in others it appears to be a very significant explanatory variable.

The result which stands out above all others is the high multiple correlations which are obtained for all the regressions fitted. Once again this result parallels that of many other analyses and provides strong support for the existence of a stable demand-for-money function consisting of a manageable number of explanatory variables and capable of explaining the greater part of changes in desired money holdings in Australia over a long period.

#### E. What is the Scope for Further Work?

##### I. Limitations of information

The empirical analysis of the demand-for-money function is subject to a number of limitations, some of which apply specifically to the analysis undertaken in this thesis although most are of general application. Several limitations were

discussed in the early part of chapter five<sup>8</sup> and we shall not deal with them here. There are however certain other limitations which deserve a mention at this point. One of these arises from the existence of institutional change or changes in habits. These factors are non-measurable, or at least very difficult to measure and therefore they cannot be introduced into a statistical analysis of the demand-for-money function and their influence, where significant, will reveal itself in unsatisfactory results. A closely connected limitation refers to the availability of information. Many of the explanatory variables used are fairly readily measurable and are in fact measured. In other cases the precise information required is not available and some substitute which approximates to the desired series must be used. However although the available information does not meet all the requirements of empirical studies there is sufficient data available to enable a considerable expansion of and improvement in the empirical analysis undertaken in chapter five.

## II. Scope for further work

Within the limitations set by the available information there are many opportunities for the expansion of the analysis presented in chapter five which is essentially limited in scope. For one thing there may be explanatory variables other than

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8. See pp. 186-204, above.

those considered which are of importance; for example: total assets,<sup>9</sup> other interest rates and indicators of expectations about economic conditions such as the rate of change of income and employment. Also the use of some of the explanatory variables with time lags might provide useful results. Again it might be worthwhile to experiment with various types of non-linear functions. One which has often been used is the logarithmic function and there may well be other types which would fit the data better than the linear form. Sectoral analyses could also be undertaken to see what sorts of relationships appear relevant for particular sectors. Such sectoral analyses could throw a good deal of light on the nature of the aggregate demand-for-money function. We could also look at other time periods than those examined, and in particular attention could be directed towards short-run analysis using monthly or quarterly data. For this sort of analysis flow-of-funds data would be extremely useful. Among the analyses examined in chapter four that of Turvey<sup>10</sup> is based on flow-of-funds information. However, except for the fairly recent publication of the Reserve Bank of Australia,<sup>11</sup> which provides flow-of-funds data for the period 1953-54 to 1957-58, no such

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9. As is mentioned in chapter five the variable outstanding government debt may well be an indicator of total assets. See pp. 211-218 above.

10. Turvey, R. Interest Rates and Asset Prices. 1960.

11. Holmes, A. S. Flow-of-Funds Australia, 1953-54 to 1957-58. Reserve Bank of Australia, Staff Paper, 1960.



information is available in Australia so its usefulness is somewhat restricted. A source of information which is not available at all is savings survey data such as that used by Lydall<sup>12</sup> in his study of the U.S. However in spite of the limitations which are imposed on empirical investigations in Australia it can be seen that there are many opportunities for further empirical study in the field of the demand for money in this country where it has been neglected in contrast to the U.S. and to a lesser extent the U.K.

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12. Lydall, H. F. Income, Assets and the Demand for Money (in Rev. Econ. Stats. Vol. 40: 1-12, 1958).

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